# POPULAR SCIENCE

Apr. 1950 25¢ Monthly

What Is the H-Bomb? page 141

?

BORG-WARNER
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GYROMATIC
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PRESTOMATIC
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ULTRAMATIC

## What You Should Know About Automatic Drives

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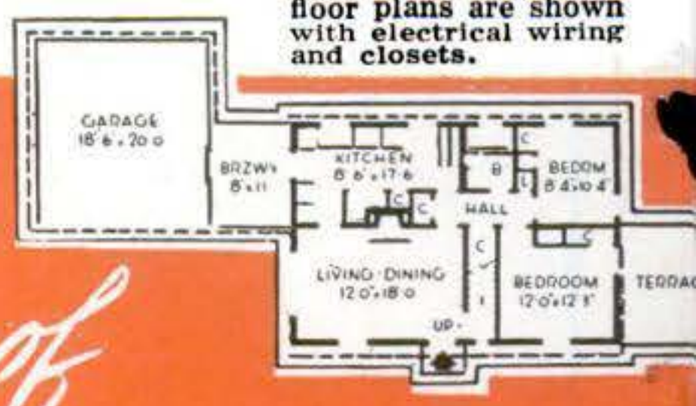
Note spacious size and cross ventilation of rooms in this ground plan. In the book all floor plans are shown with electrical wiring and closets.




# Build Any One of 8 Beautiful Homes Yourself *with the aid of*

# "*Your Dream HOME— how to build it for* LESS THAN $3500"

This Modern Suburban Home for the Growing Family Has Separate Dining Room and Space for 4 Bedrooms. Designed by Victor Civkin, A.I.A.

YOU Can Build this $10,000 Modern Cape Cod Cottage for Less Than $2700! Save $7300! Designed by Carl Sigman.

Courtesy Portland Cement Ass'n

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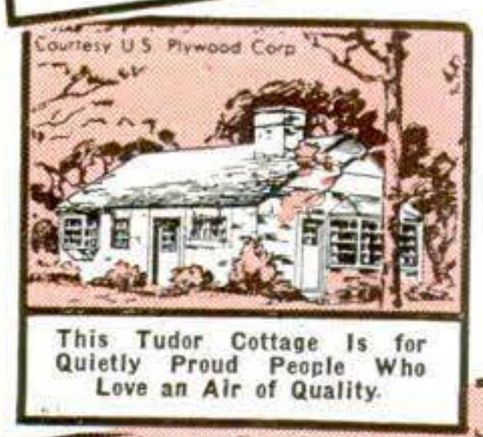

Courtesy U.S. Plywood Corp

This Tudor Cottage Is for Quietly Proud People Who Love an Air of Quality.

This Easy-to-Build Spacious Ranch House Was Designed for Gracious Living, by C. R. Stork. Has Big Picture Window Overlooking Rear Garden.

*Prepared by Nationally-known Building Experts and Edited by Famed "Handyman" Hubbard Cobb*

**Variety of Designs for Every Taste! For Every Neighborhood! Complete Building Plans and Instructions Show You How to**

## SAVE 75 CENTS ON EVERY DOLLAR!

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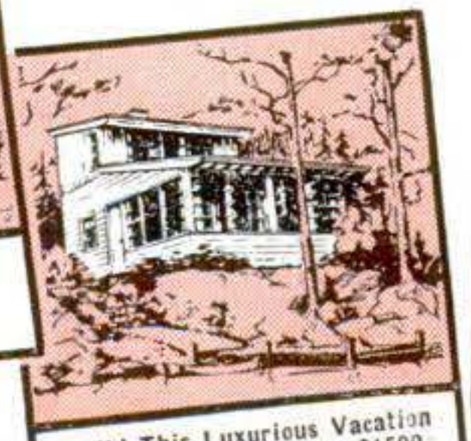
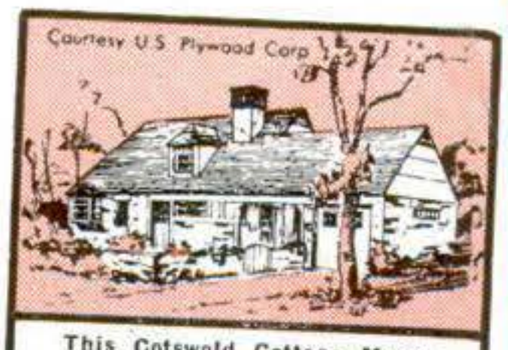
Think of it! No longer need price tags of $9,000 to $25,000 and more stand between your family and the home of your dreams. No longer need you put up with crowded, inferior quarters at exorbitant rentals. YOU yourself can build a showplace home at savings up to 75%! Or a Vacation Home in the mountains, lake, or seashore—a $6,000 value you'll enjoy building for only $1,500!

**EVEN IF YOU ALREADY OWN A HOME,** this remarkable book will save you thousands of dollars with its clear directions which make it easy for you to Build a Garage—Build Modern Streamlined Kitchen or Bathroom—Install Extra Closets, or even Build a Whole New Apartment or "Extra" House for highly profitable rental income!

**FULLY ILLUSTRATED—ALL MATERIALS LISTED!** For each of 8 houses, there are complete material lists of EVERYTHING you need down to the last nail. Take any list to your building supply dealer and he will give you your exact total cost. After you select the house you want to build, just open the book and start in! Every tiniest detail explained! Over ¼ MILLION words and hundreds upon hundreds of specially prepared pictures and charts make every step clear!



Build This Luxurious Vacation Hideaway for Less Than $1500. Save $4500! Designed by Carl Sigman.



Courtesy U.S. Plywood Corp

This Cotswold Cottage Means Love at First Sight for Some Proud Housewife

### Learn How to Finance Without One Cent of Cash!

Learn how to get an FHA loan up to 95% of the finished appraisal value! With materials costing less than 35%, many amateur home builders have actually been able to pay themselves a salary out of the mortgage loan, while building . . . Or, to own your home free and clear, book shows how to start with little or no savings, "pay as you go."

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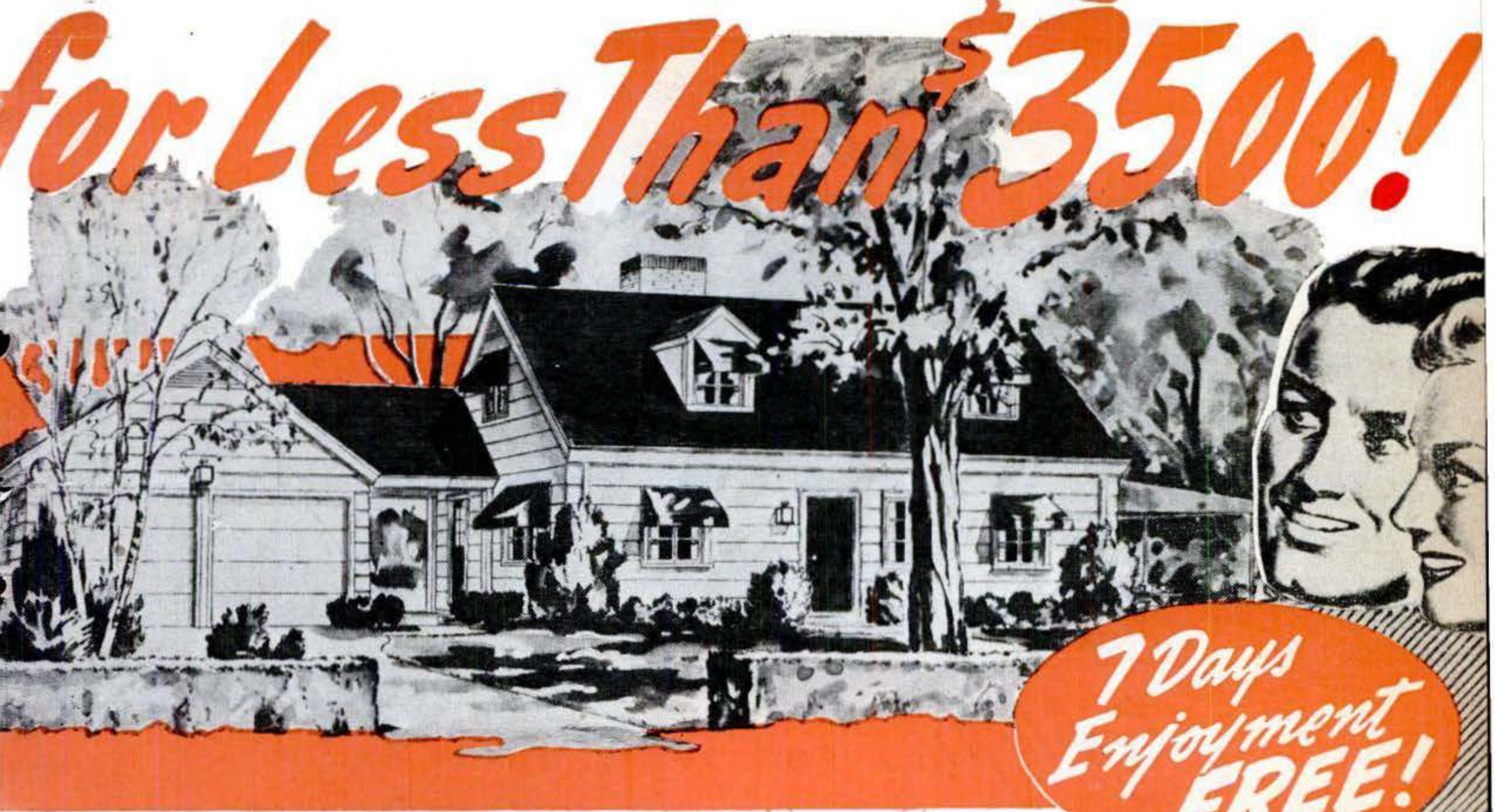

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How to Position House to Make Most of Lot; Clearing Trees, Rocks

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Nailing Wall Studs to Floor Joists
Framing the Walls
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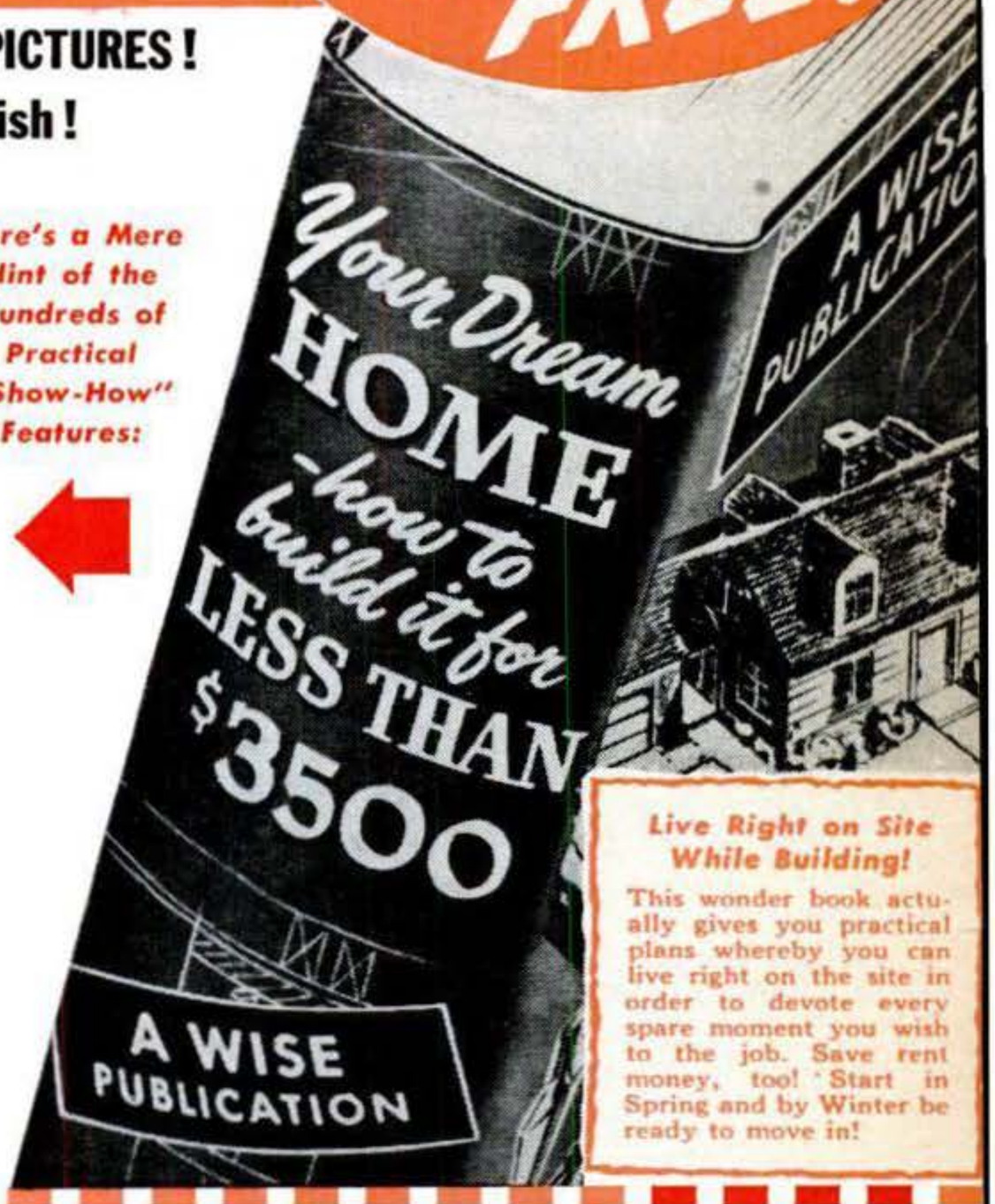


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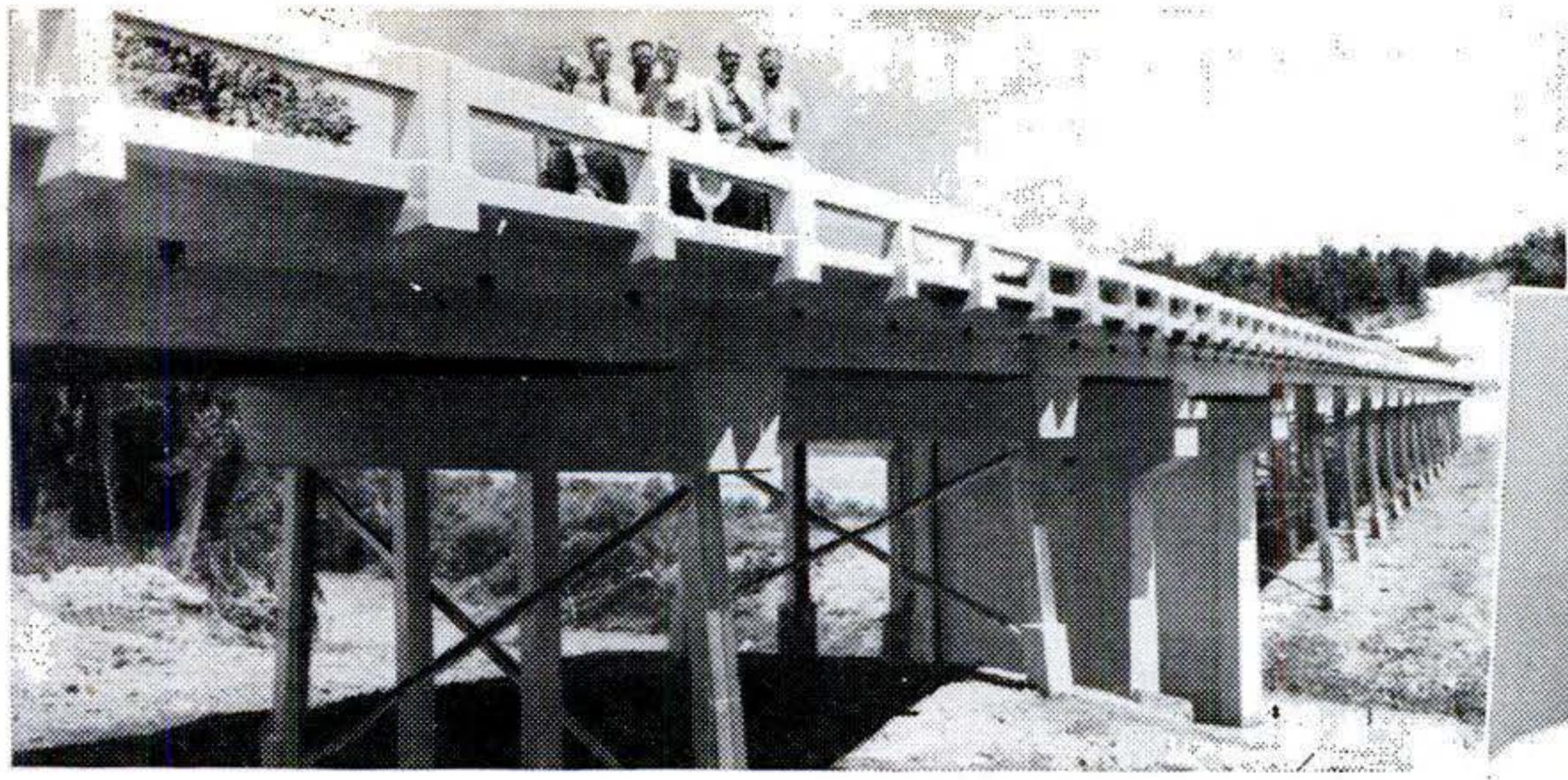

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## Mechanics of Farming

*Ladd Haystead*

IN THIS issue POPULAR SCIENCE starts a new feature— "Mechanics of Farming." The writer, Ladd Haystead, is widely known as the country's No. 1 farm journalist. He has studied farming in all 48 states; he has owned or managed farms in 15 of them. You probably have seen his articles in this or other magazines. Now Haystead will report regularly to PS readers on what's new in farm machinery, tools, power equipment, and ways farmers can use science and mechanics to save work and make money. You will find his first report from the field on page 242.




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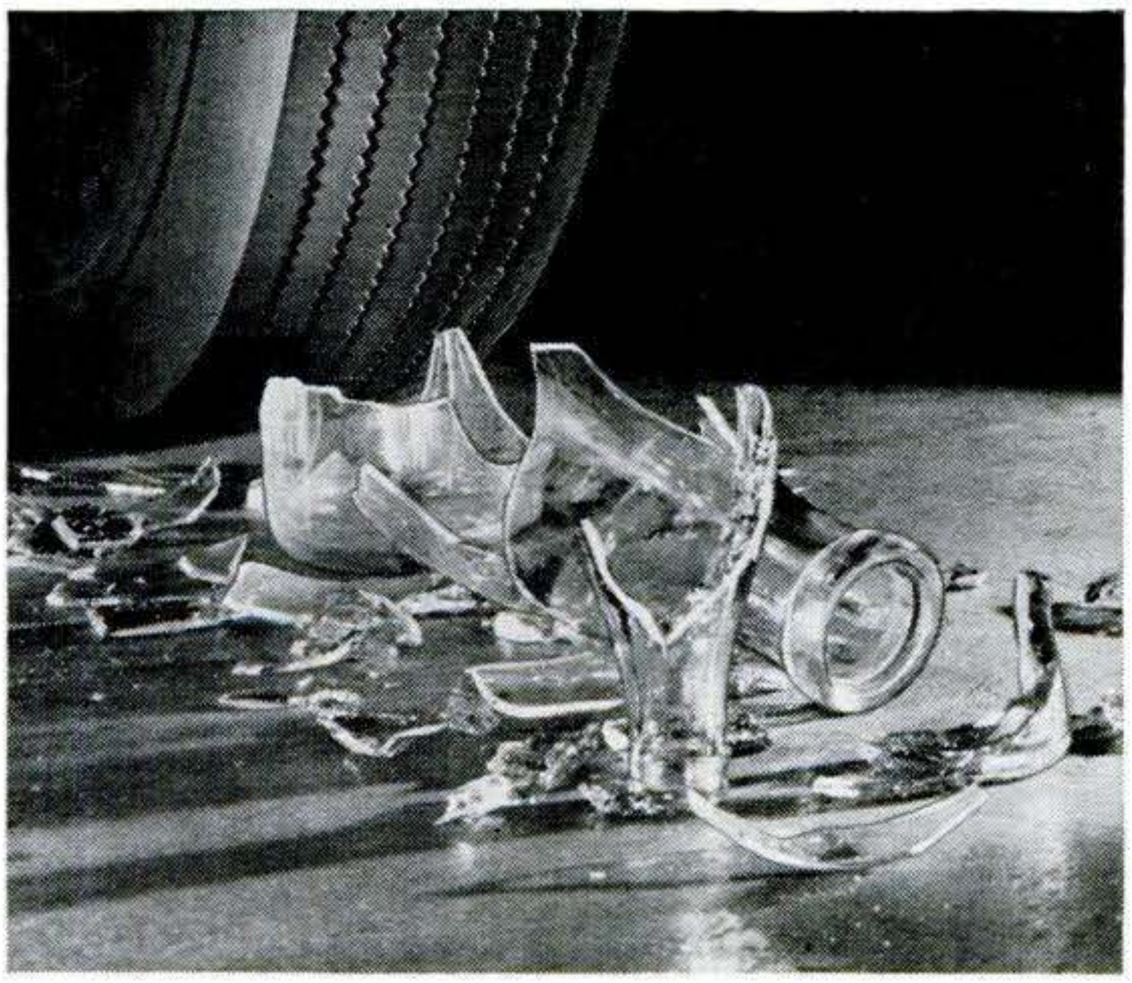
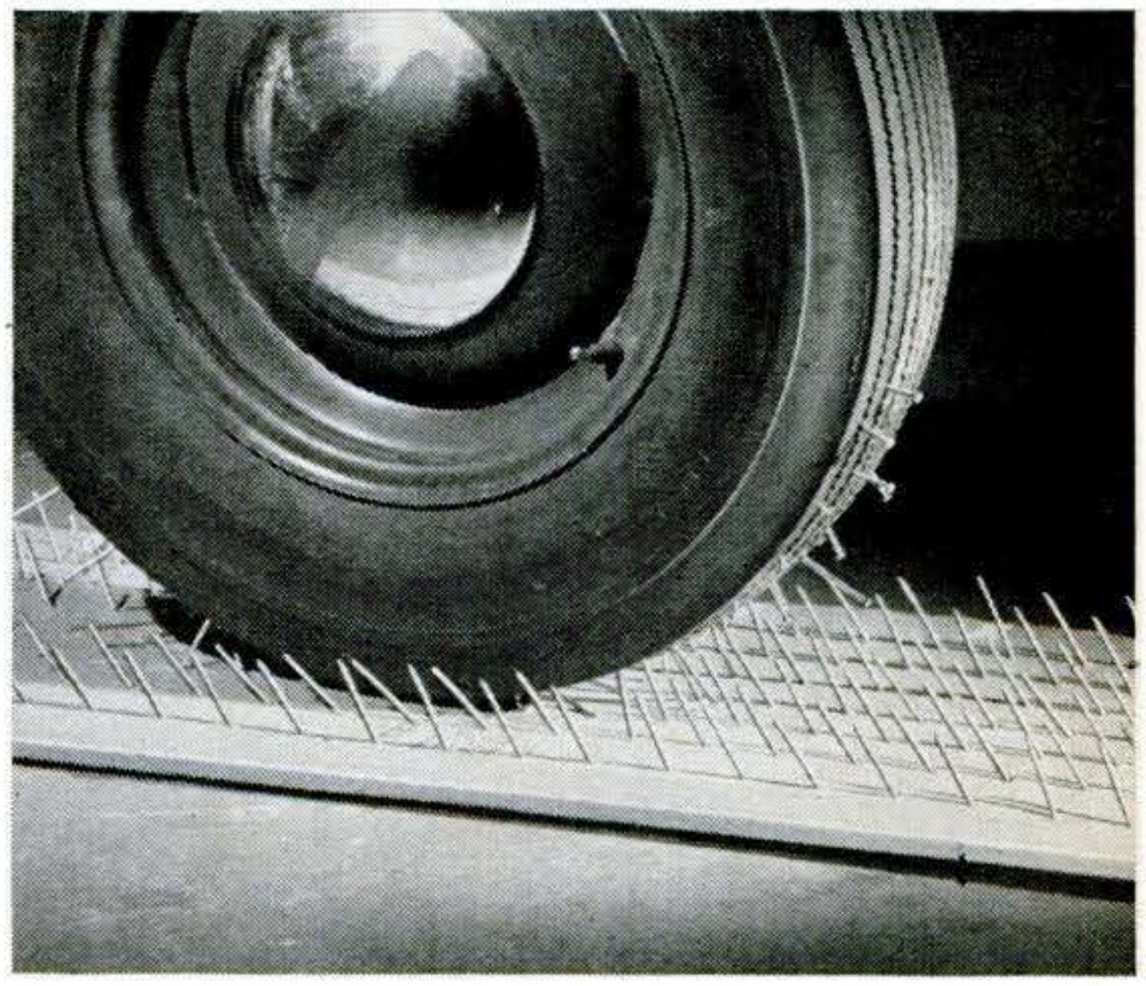
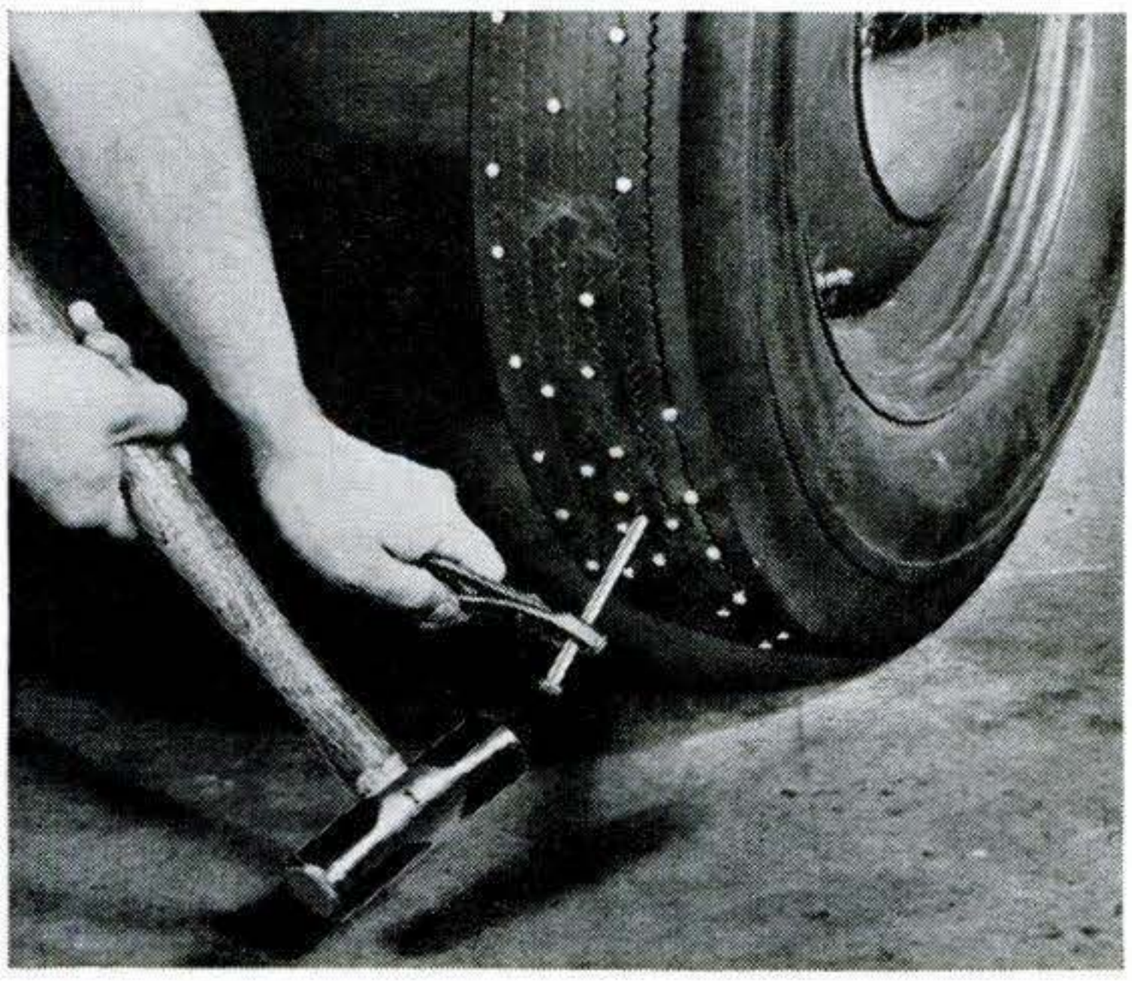
# THE TUBE *NO ONE* CAN IMITATE!



**1.** EVEN JAGGED, razor-sharp glass won't make *this* tire go flat—it's equipped with a Seiberling Sealed-Air Tube, *the tube no one can imitate!* Because the Seiberling Sealed-Air Tube is *different from any other in the world,* it gives you puncture and blow-out protection you can get in no other way!



**2.** HERE YOU SEE the same tire being punctured *hundreds* of times, picking up more nails than you'll pick up in a lifetime of driving. And what happens? Nothing . . . each puncture is sealed *permanently* while you ride—no tire changing, no delays, no repair bills or ruined casings!



**3.** CHANCES ARE you'll never pound spikes into *your* tires. But Seiberling Sealed-Air Tubes can take even *this* extreme punishment because they're built around a revolutionary principle of tube design perfected and patented by Seiberling . . . built to give you *many years* of amazingly economical puncture and blow-out protection *in set after set of tires!*

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## . . . WITHOUT GOING FLAT?

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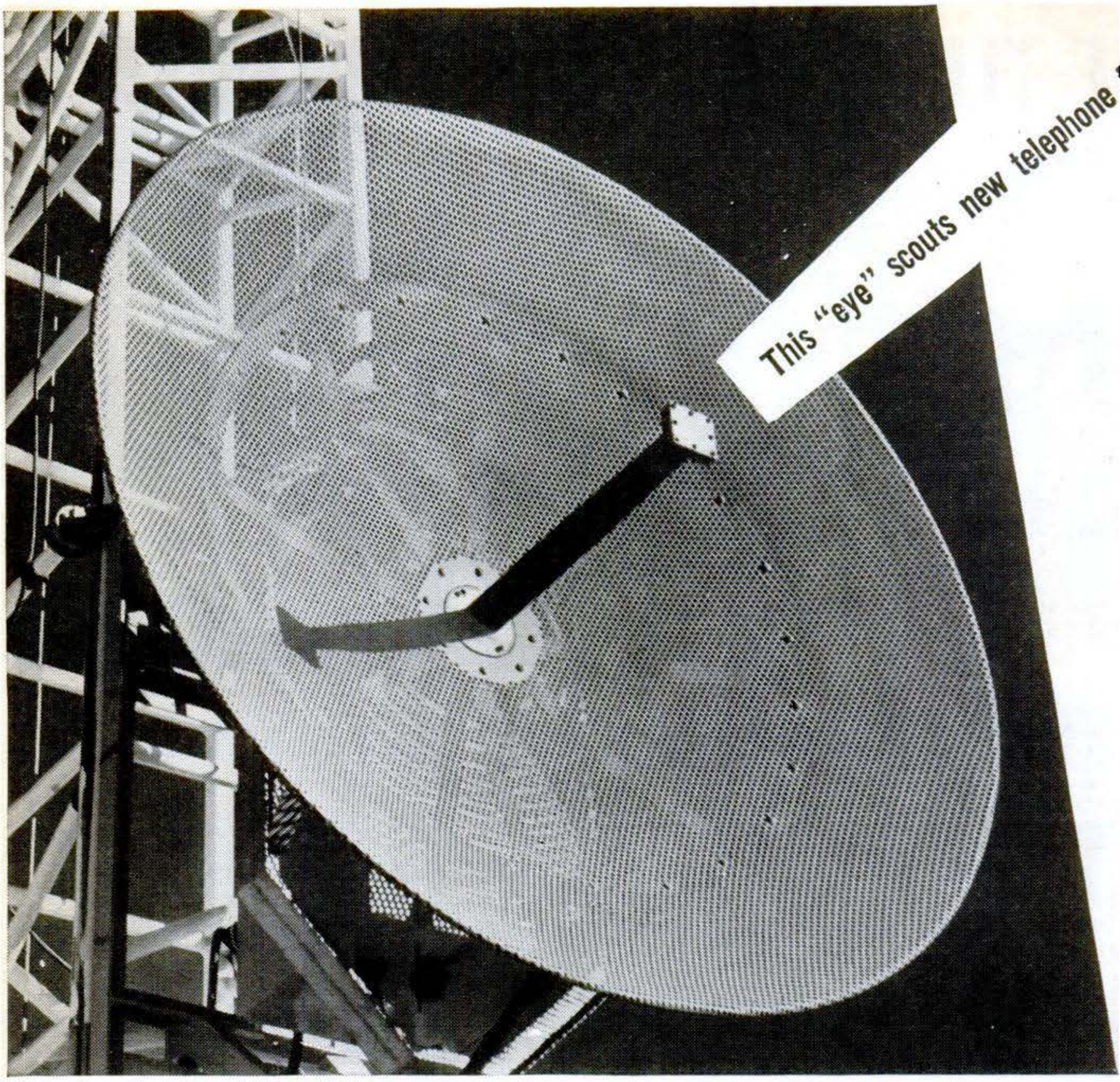


Throughout history, scouting parties have gone out ahead of man, ahead of settlements, ahead of civilization itself. Today, Bell System scouts are engaged in a new kind of exploration — charting a path for microwaves — using equipment specially designed by Bell Telephone Laboratories.

The portable tower shown is constructed of light sections of aluminum and in a few hours may be built up to 200 feet. Gliding on rollers, the "dish," with its microwave transmitter or receiver, is quickly positioned for line-of-sight transmission, then oriented through electric motors controlled from the ground.

Test signals show how terrain and local climate can interfere with microwave transmission. Step by step, Bell's explorers avoid the obstacles and find the best course for radio relay systems which will carry television pictures or hundreds of simultaneous telephone conversations.

A radio relay link similar to the one between New York and Boston will be opened this year between New York and Chicago. Later it will be extended, perhaps into a nation-wide network — another example of the way Bell Laboratories scientists help make the world's best telephone system better each year, and at lowest cost.

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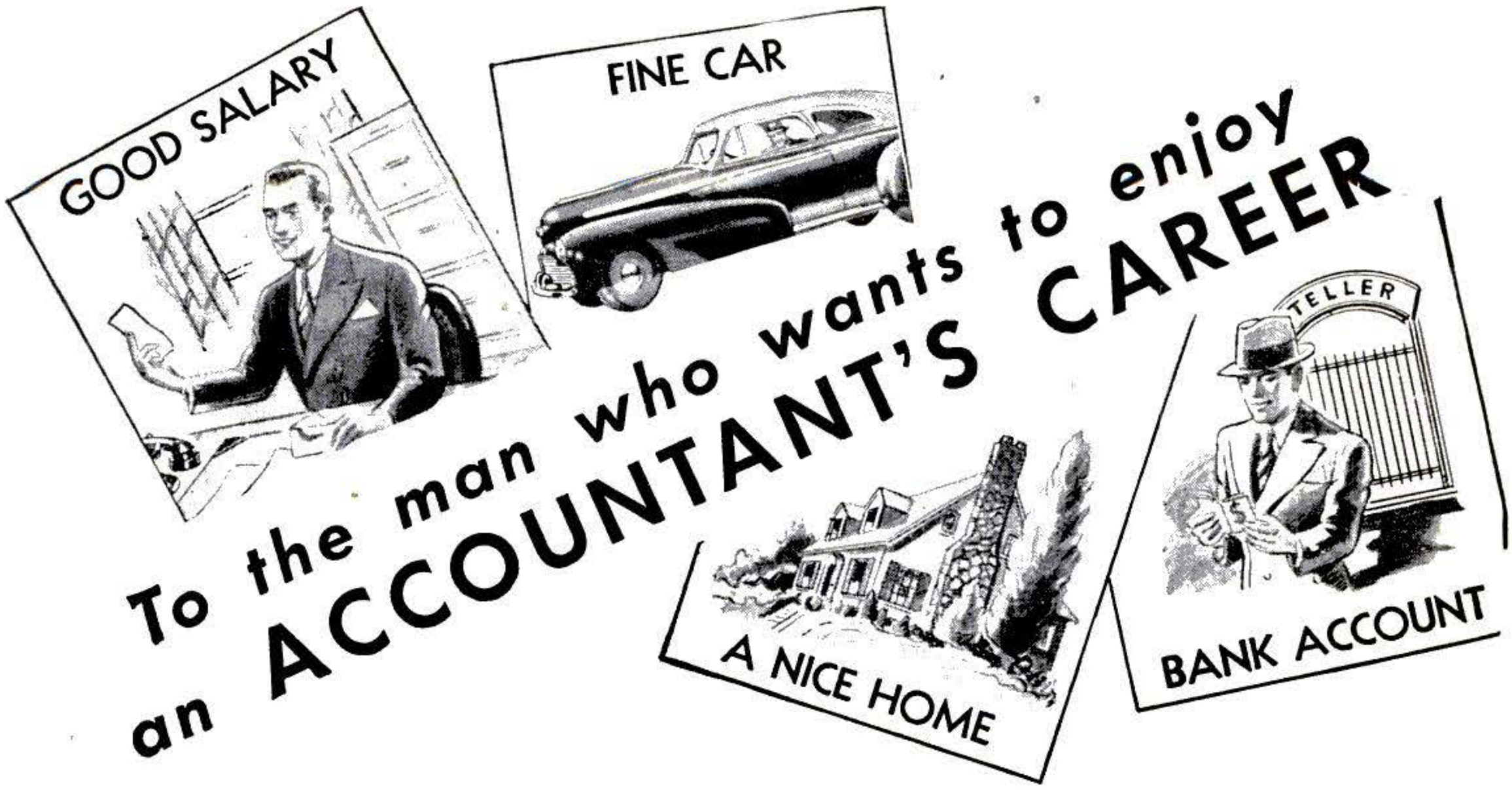


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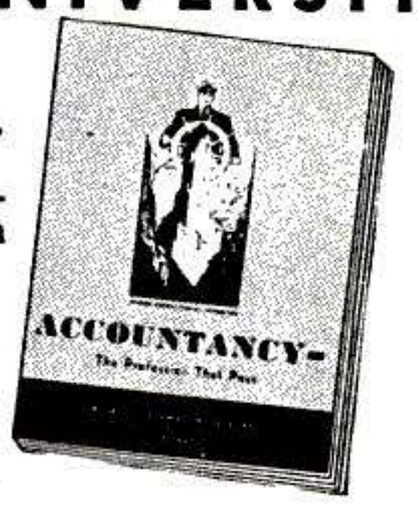




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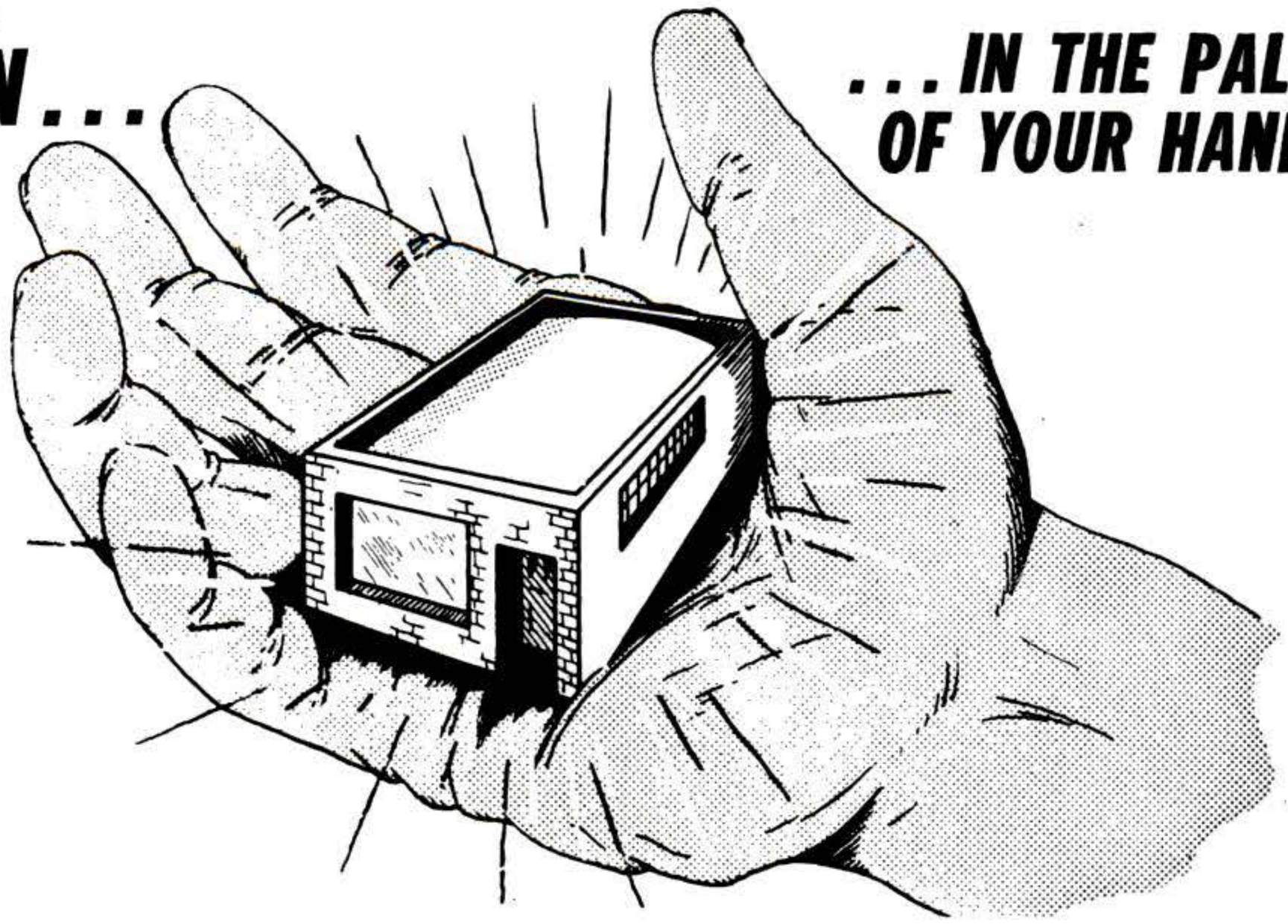

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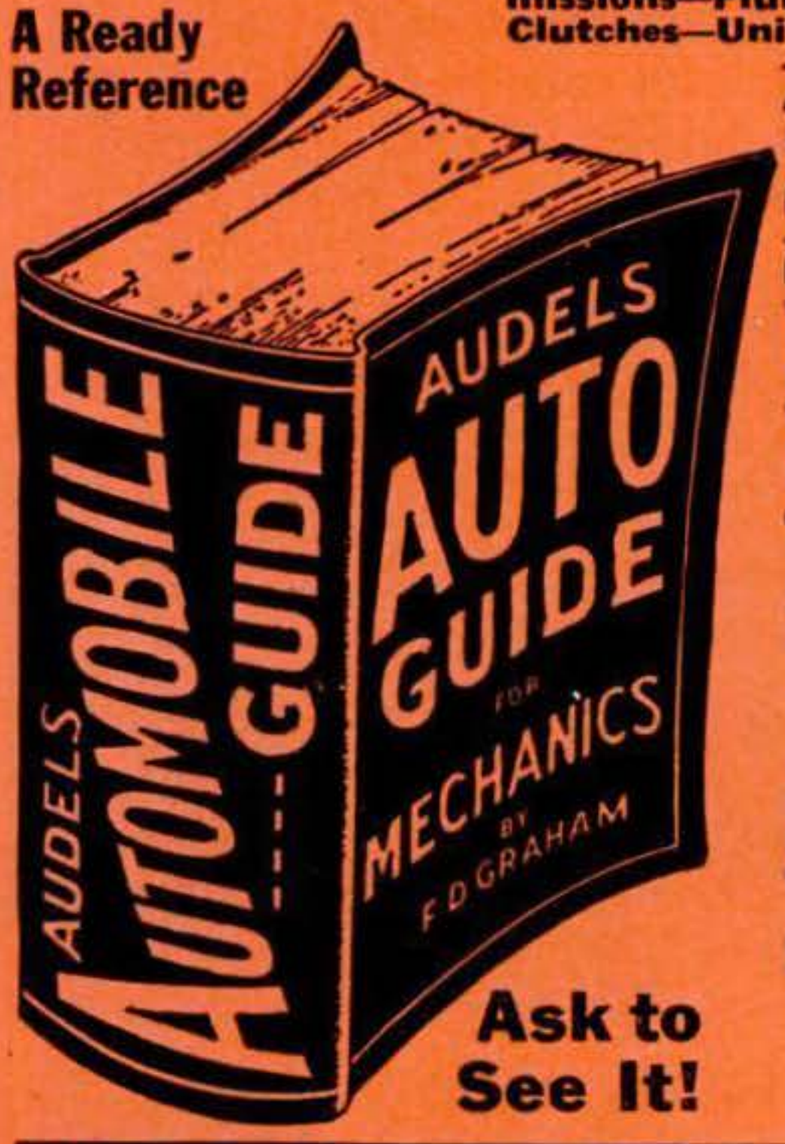


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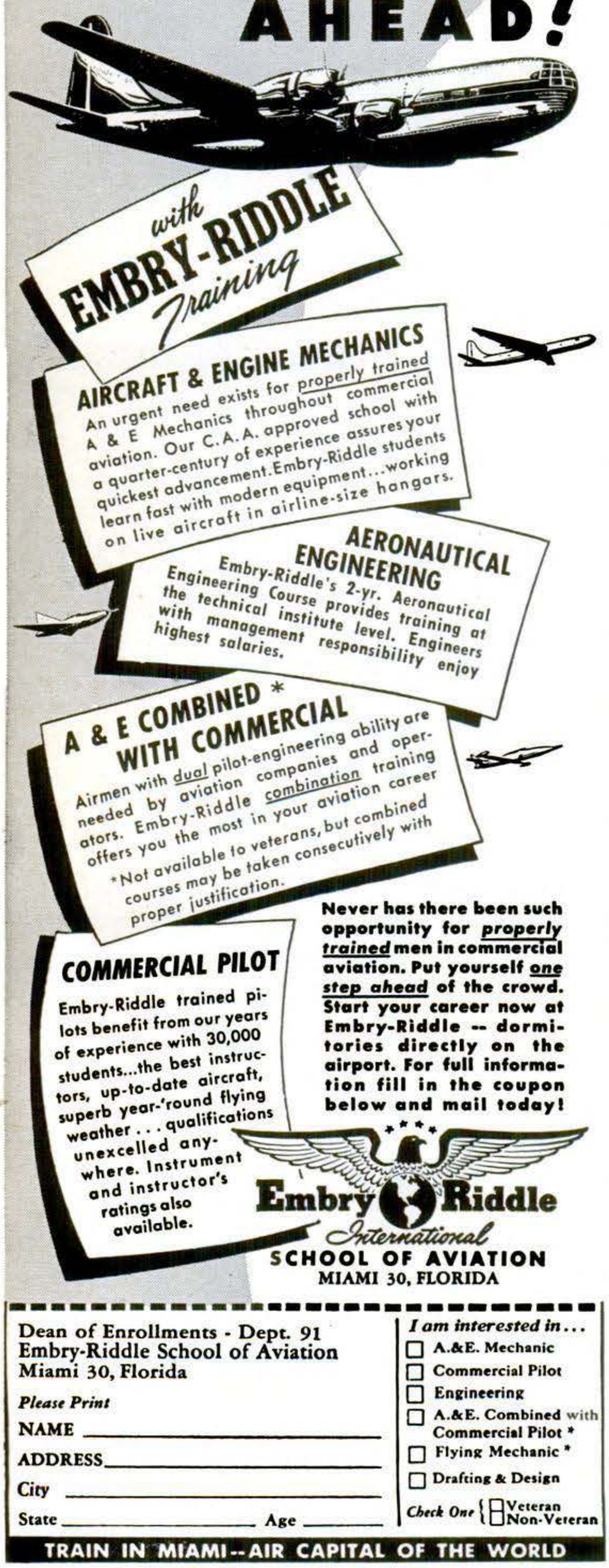

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# Letters

### How to Evaluate a Car

Sir:

I have found great enjoyment in reading your magazine, but I think you could make one improvement. Why not run a monthly article describing critically a certain make of car. Give a short summary of its good and bad points—the real low-down.

DONALD HOLE

Reading, Pa.

*We think it takes more than a heavy foot to test as complex a piece of machinery as an automobile. A road run, even with an expert driver, is a small sample on which to base an opinion covering thousands of cars of the same make in several different models. Especially in a country where climate, altitude, and the conditions of use vary so greatly. For the best indication of any car's "value" to the people who pay for it, check the going prices on the nearest stock exchange—the local used-car lots.*

### Substitute for Refueling

Sir:

Refueling in flight [PS, Feb., p. 114] strikes me as a clumsy way of getting more range out of airplanes. My simpler suggestion is based on the fact that a plane, once in the air, can carry more than it can lift off the ground. So why not put in extra tanks—and give it a take-off boost with a towing cable, powered by a high-speed winch built into the runway?

DONALD A. HIPPLE

Wagner, S. D.

### Seller's Market?

Sir:

Defenders of the new cars say the public must like them or it wouldn't buy so many. Now I ask you: Has the public any choice?

B. NORLANDER

Stillwater, Minn.

### P.S. Idea Travels Far

Sir:

I want to thank you, belatedly, for intro-



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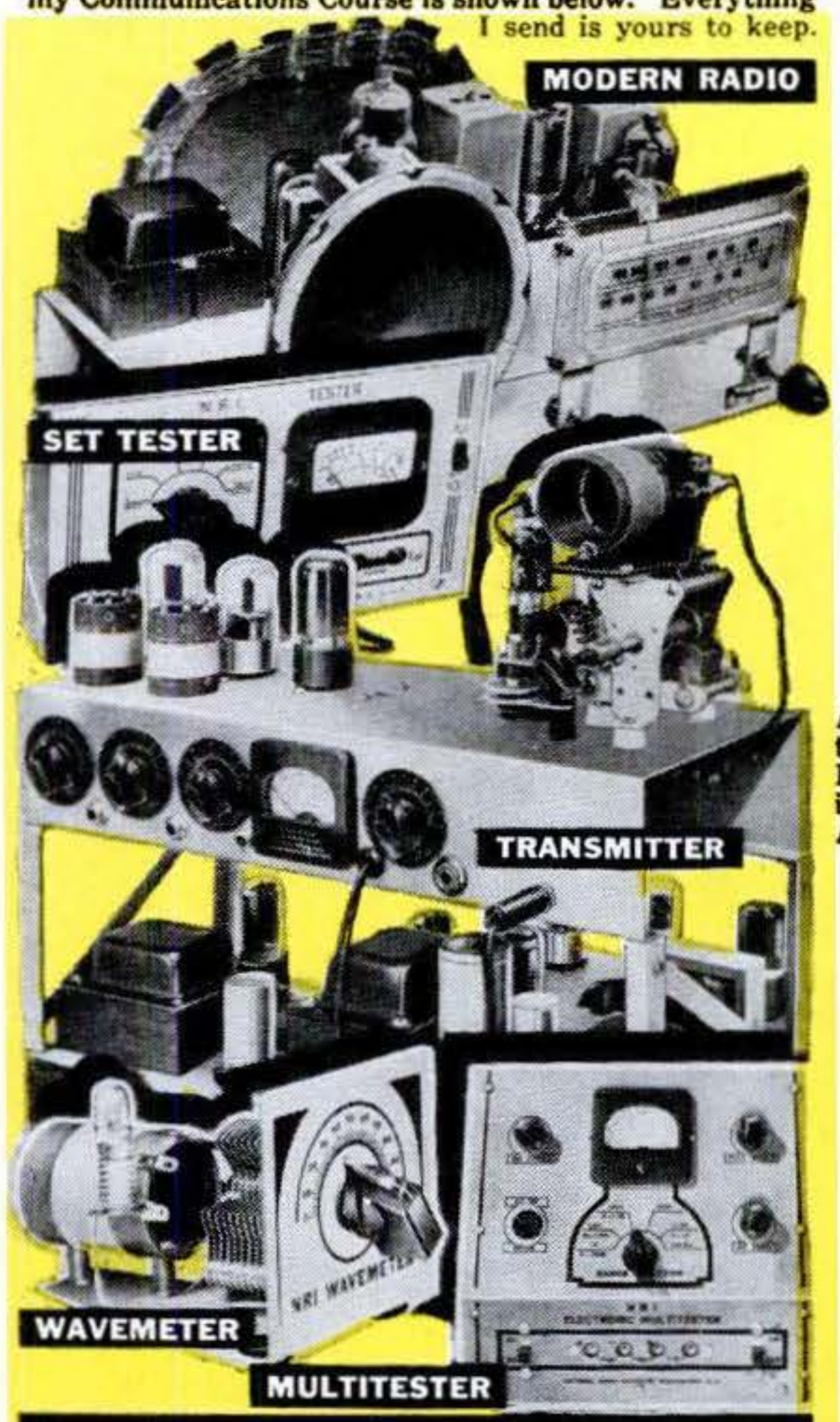


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The day you enroll, I start sending SPECIAL BOOKLETS that show you how to make $5, $10 a week or more EXTRA MONEY fixing neighbors' Radios in spare time while learning. From here, it's a short step to your own shop or a good-pay Radio-Television servicing job. Or be a licensed Radio-Television Operator or Technician.

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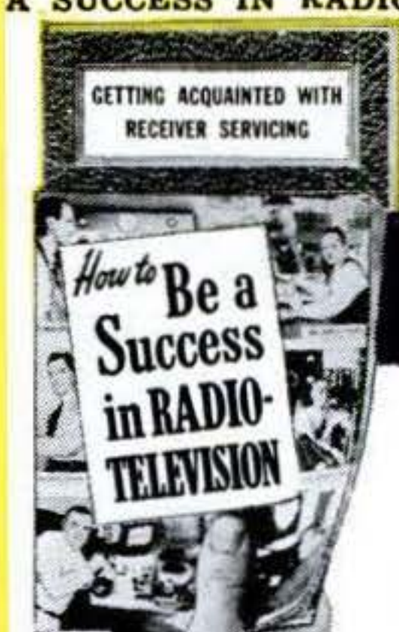


### I TRAINED THESE MEN

"Before finishing course, I earned as much as $10 a week fixing Radios at home in spare time. Recommend N. R. I."—S. J. Petruff, Miami, Florida.

"My first job was obtained for me by your Graduate Service Dept. Am now Chief Engineer, Police Radio Station WQOX."—T. S. Norton, Hamilton, Ohio.

"N. R. I. was my stepping stone from a few hundred to over $4,000 a year as a Radio Engineer. Make extra money servicing Radios."—A. B. Michaels, Trenton, Ga.

"I am operating my own Radio Sales & Service business. With FM and Television in the offing, we have a very profitable future."—A. Patrick, Tampa, Fla.

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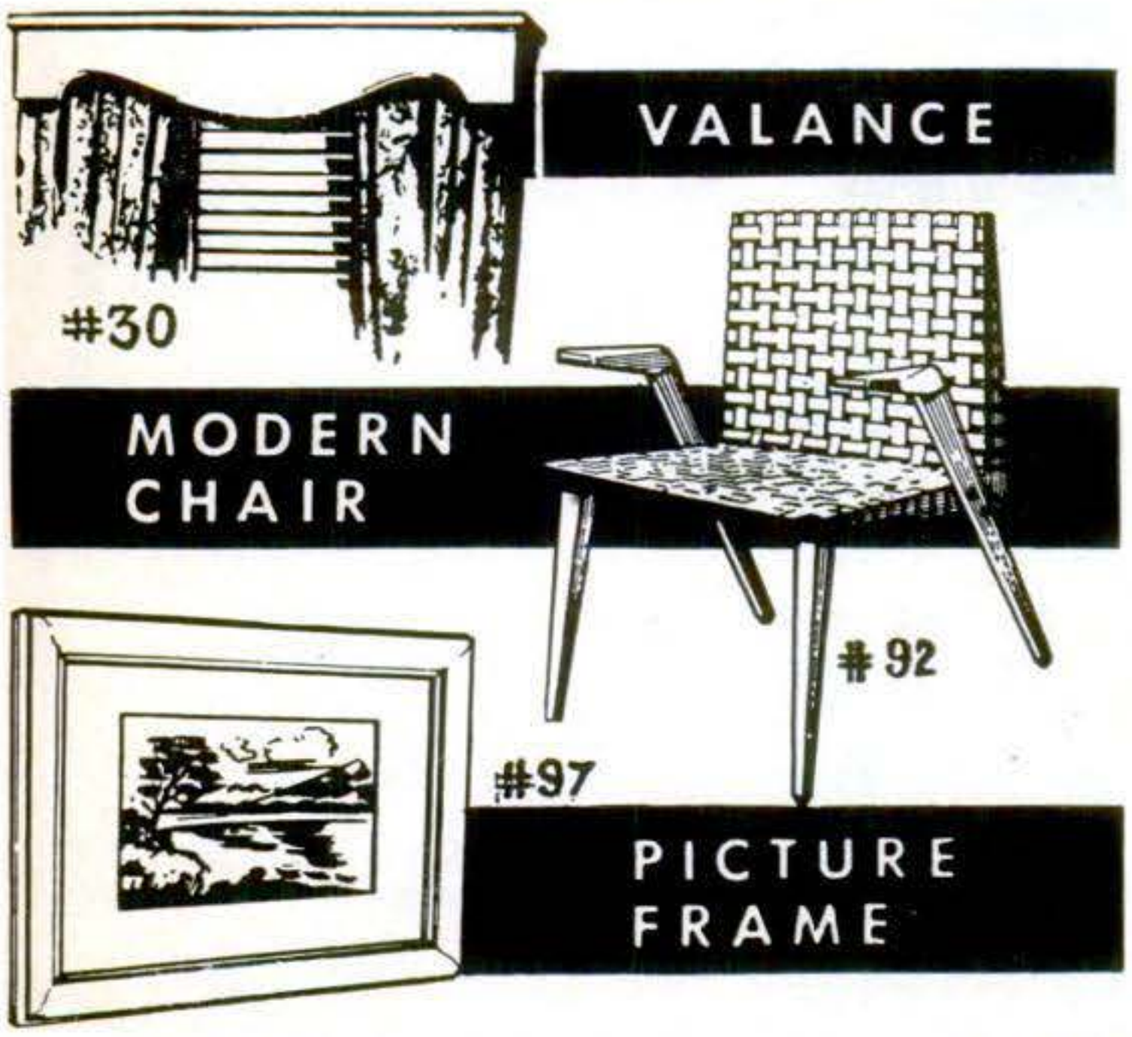


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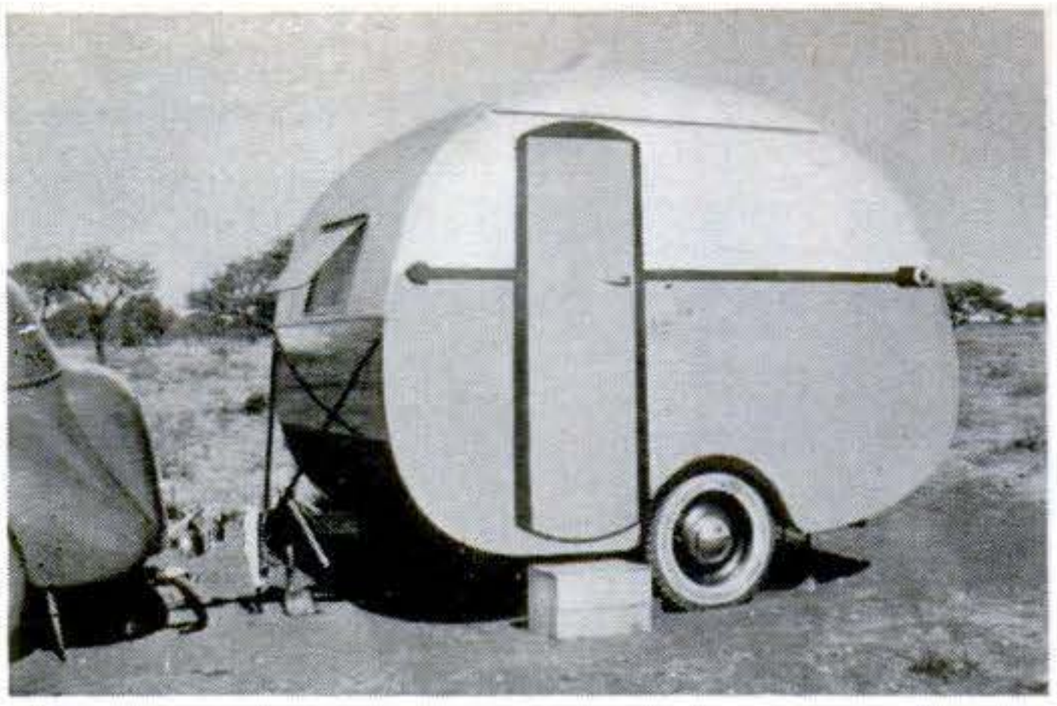

***Wanderbug in South Africa***

ducing me to the joys of spending a holiday in a trailer caravan. My Wanderbug [above], built from the plans you published four years ago [March, '46, p. 146] cost me 12 months of working in my spare time. And it was certainly worth it.

A. H. Bell

Capetown, South Africa

### Pocket Aid for Salesmen

Sir:

As a salesman, I have found that much of my time is spent waiting to see my customers. So I have found, also, that it is handy to keep one of the science magazines in my overcoat pocket or brief case. Then, while waiting, I not only can get in a lot of reading, but can finish articles without having to leave them in the waiting room. Also, in your kind of magazine, I don't run into continued stories.

I believe, in fact, that I can credit about 25 percent of my business to these science and mechanics magazines, especially Popular Science. From PS I get many ideas about where to sell my products (industrial tapes) and, by reading about different manufacturing processes, I find that I can talk more intelligently with my customers about their business and problems.

Deane H. Miars

Detroit

### Bismuth's Still Around

Sir:

Pointing out the short half lives of members of the Neptunium Family, your atomic-chart article [Feb., p. 147] says: "Thus all the known Neptunium Family members might have once existed on earth and now vanished."

Except of course the end product—bis-



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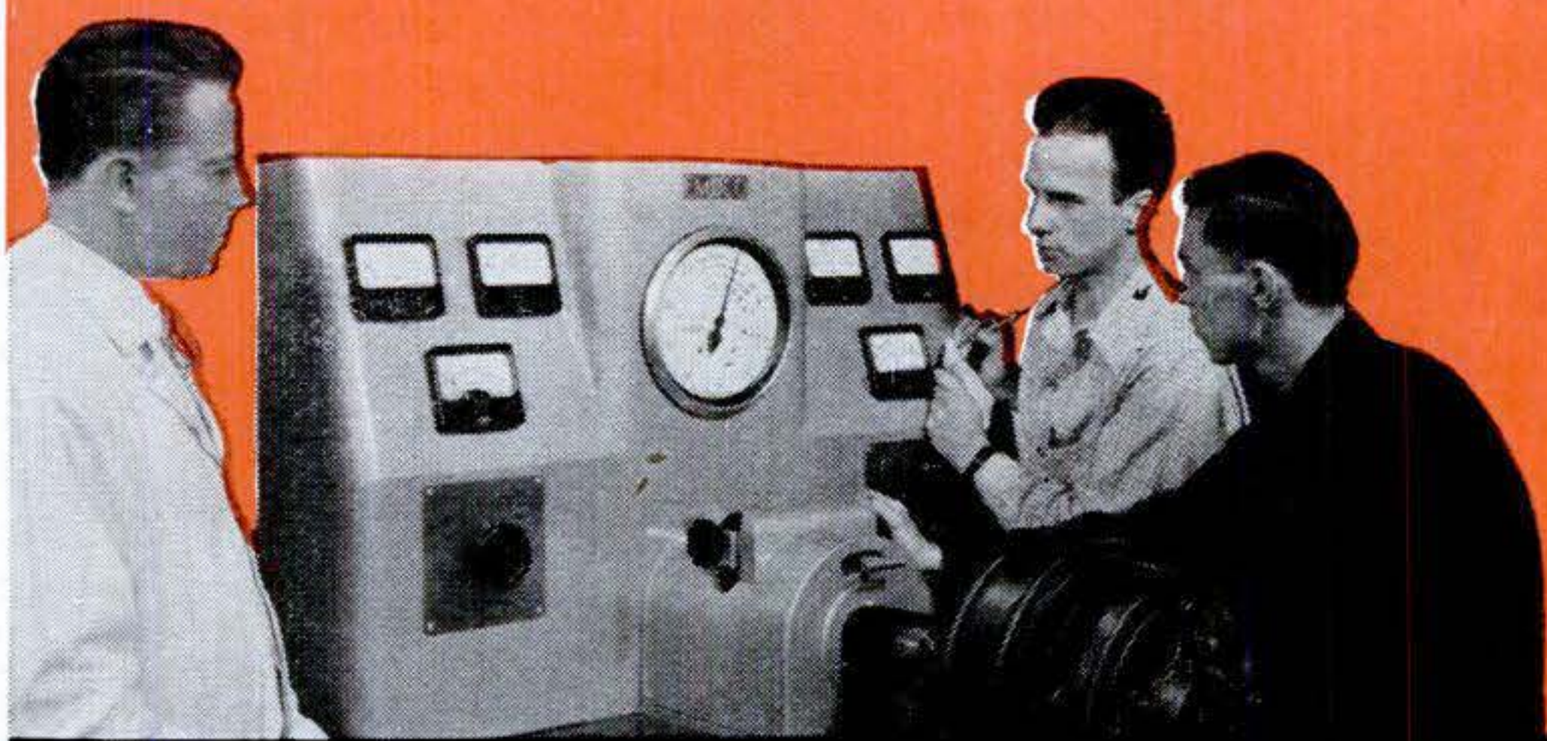

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*(Shown at left—Instructor demonstrating latest type of Test Unit for checking the efficiency of a Motor.*

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*(Right — Instructor explaining operation of 20-inch Cathode Ray tube used in Dumont Television Set.)*

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muth 209—which your accompanying Neptunium Family chart shows to be stable, and which therefore wouldn't vanish?

A CHEMISTRY TEACHER

New York, N. Y.

*Correct. It was the radioactive members that were referred to. Today's natural bismuth is 100 percent bismuth 209. Some if not all of it may be the only existing remnant of a prehistoric radioactive family.*

### Scissors with a History

Sir:

Under "Aids to Modern Living" in your February issue, p. 166, you show some new German scissors that fold up.

Modern Living, my eye!

I have in my pocket a pair of scissors just like them, and my wife has in her handbag another with mother-of-pearl handles. And do you know when I purchased those scissors? Just about 40 years ago.

ARTHUR BARG

Freehold, N. J.

. . . I purchased a pair of folding scissors at a cut-rate drugstore in Seattle 40 years ago for 25 cents.

M. L. HALL

Duluth, Mich.

. . . I had a pair some 50 years ago and still have them.

WILLARD A. DUNHAM

Middleboro, Mass.

. . . nearly 37 years ago.

G. H. MCCARTNEY

Orrville, Ohio

### Why Carrousels Go That Way

Sir:

Here is my contribution to the discussion that has been running in your Letters department [Nov., p. 18] on merry-go-rounds and carrousels, and which way they turn:

In former years the carrousel was known as the "flying jenny" or "flying horses." As a special inducement to the riders, there was an arrangement whereby a small metal ring was held by an arm or sort of bracket in such a manner that any of the riders on the outermost horses could grab the ring as he passed by. Possession of the ring entitled the holder to another ride free.



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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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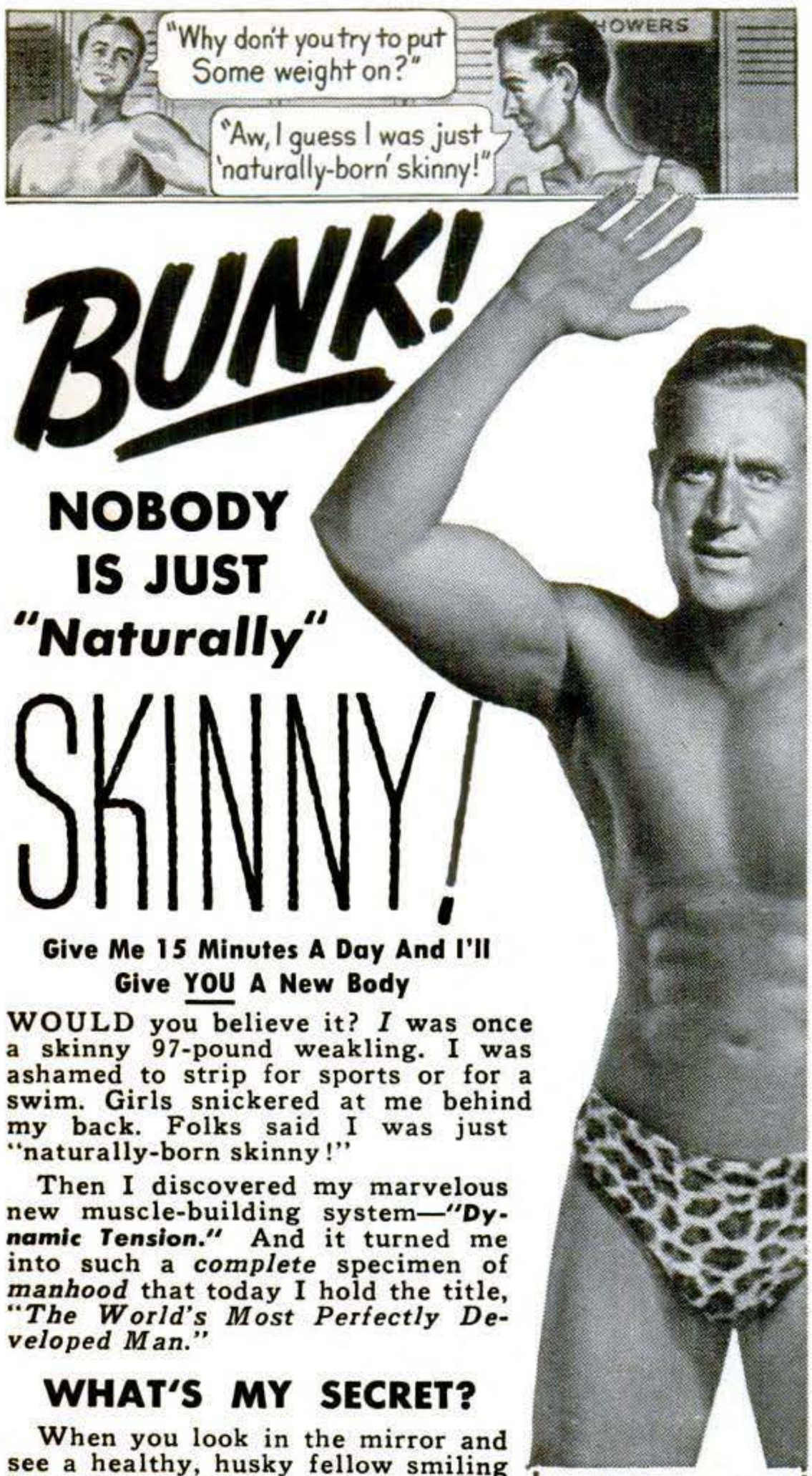


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It required some skill on the part of the rider to grasp the ring and pull it free, depending on his ability to reach out quick enough and far enough. Since most people are right-handed, it was necessary that the carrousel rotate in a counterclockwise direction, allowing a rider to reach out with his right hand while holding onto his horse with his left hand.

Nowadays, there being no ring to catch, it makes little difference which way the thing rotates.

A. E. Kirk

Galveston, Tex.

**Touchy Stuff**

Sir:

After reading your article on hydrogen peroxide [Jan., p. 153], I decided to use the demonstrations you showed as my chemistry project in school. I would appreciate receiving more detailed instructions for performing the experiments.

Harold Mege

Ridgewood, N. J.

*Concentrated hydrogen peroxide—as our article emphasized—is touchy stuff. The demonstrations we showed were carefully done by an expert chemist only as illustrations to make its various uses clearer to the reader. Details were intentionally left out, since these were not intended as experiments that could be performed at home or school.*

**Help Wanted**

Sir:

The government helps big companies with loans, etc. Why doesn't it help the poor man who has ideas and inventions with advice, free patents, and financial aid in putting his products on the market? The successful inventors could then pay back a certain percentage for the upkeep of the program.

For instance, I have just read that there is a great need of a way to take packages off trains without their having to stop. I think that could easily be done by having a crane hang a magnet over the tracks and grab off packages placed in a metal box on a open deck.

What I need now is some help in developing this idea for actual use.

Ernest Kopp

Brooklyn, N. Y.



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If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

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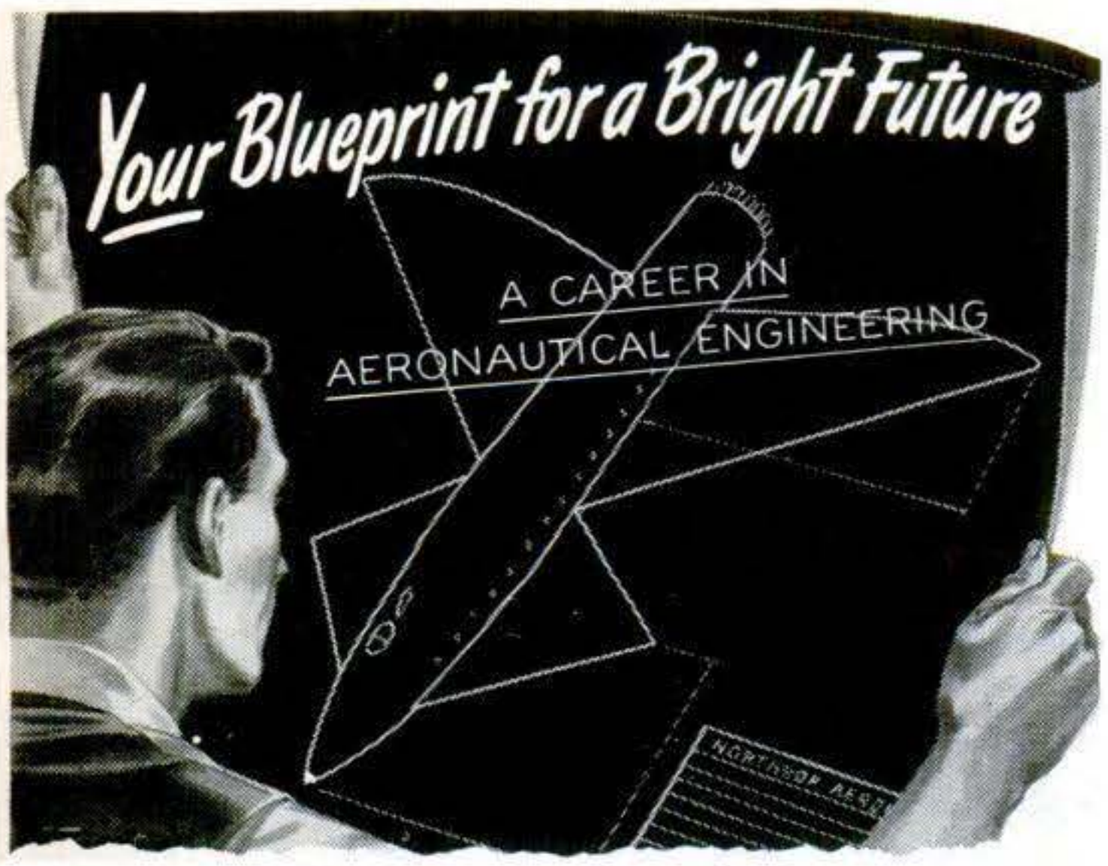


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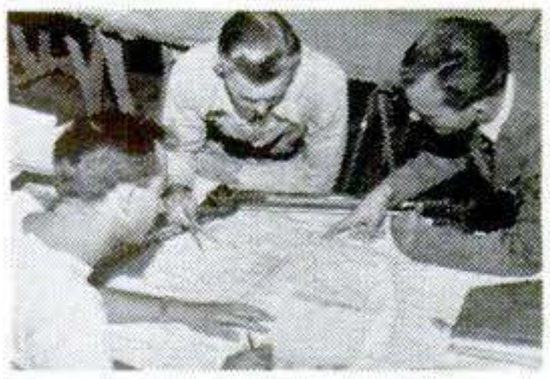

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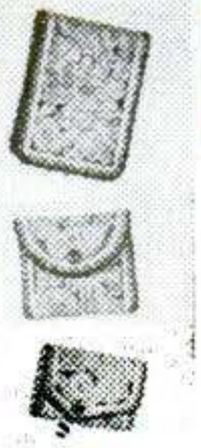

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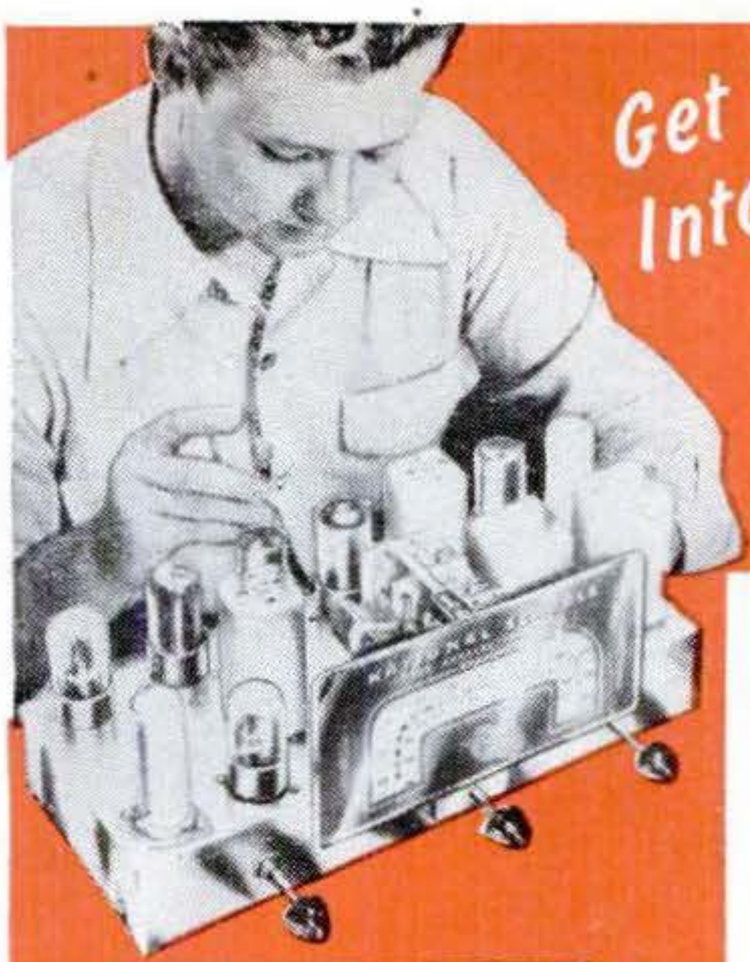

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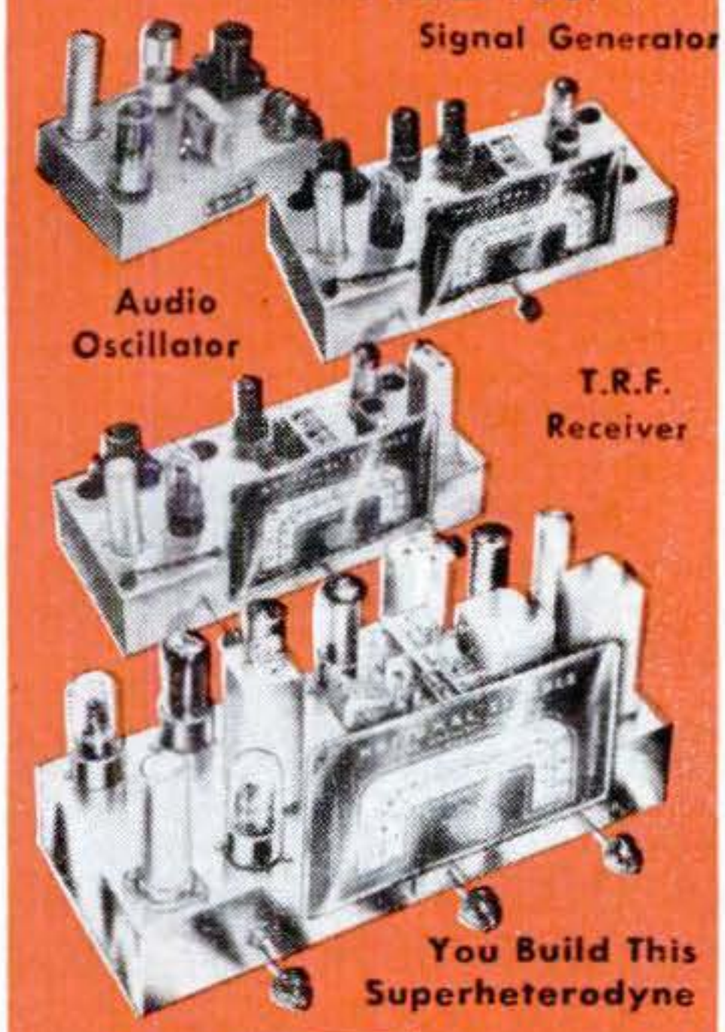


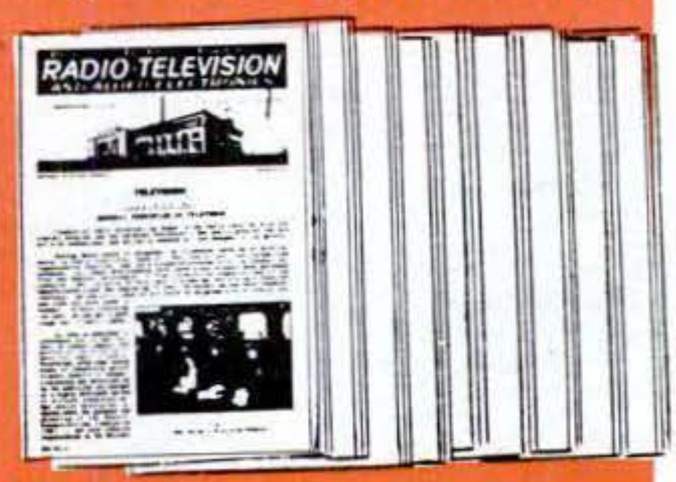


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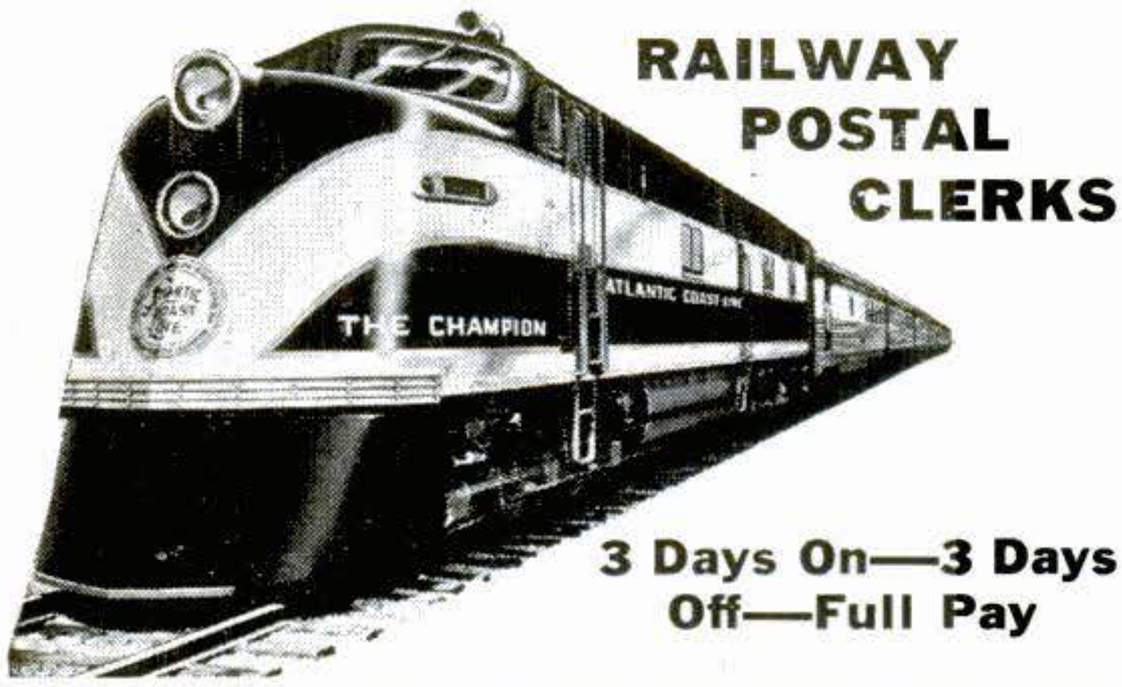


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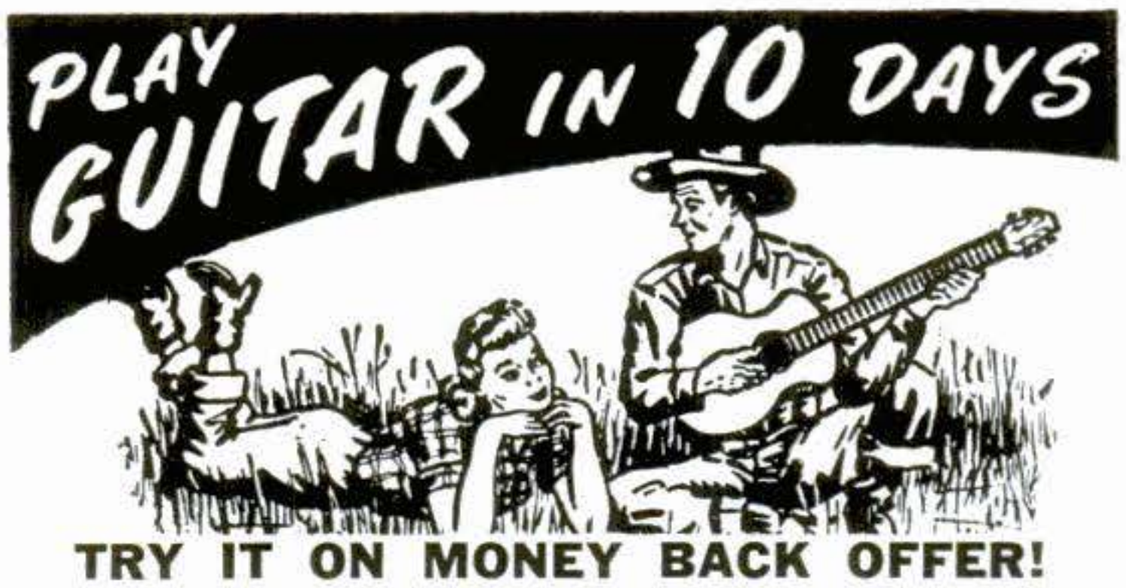


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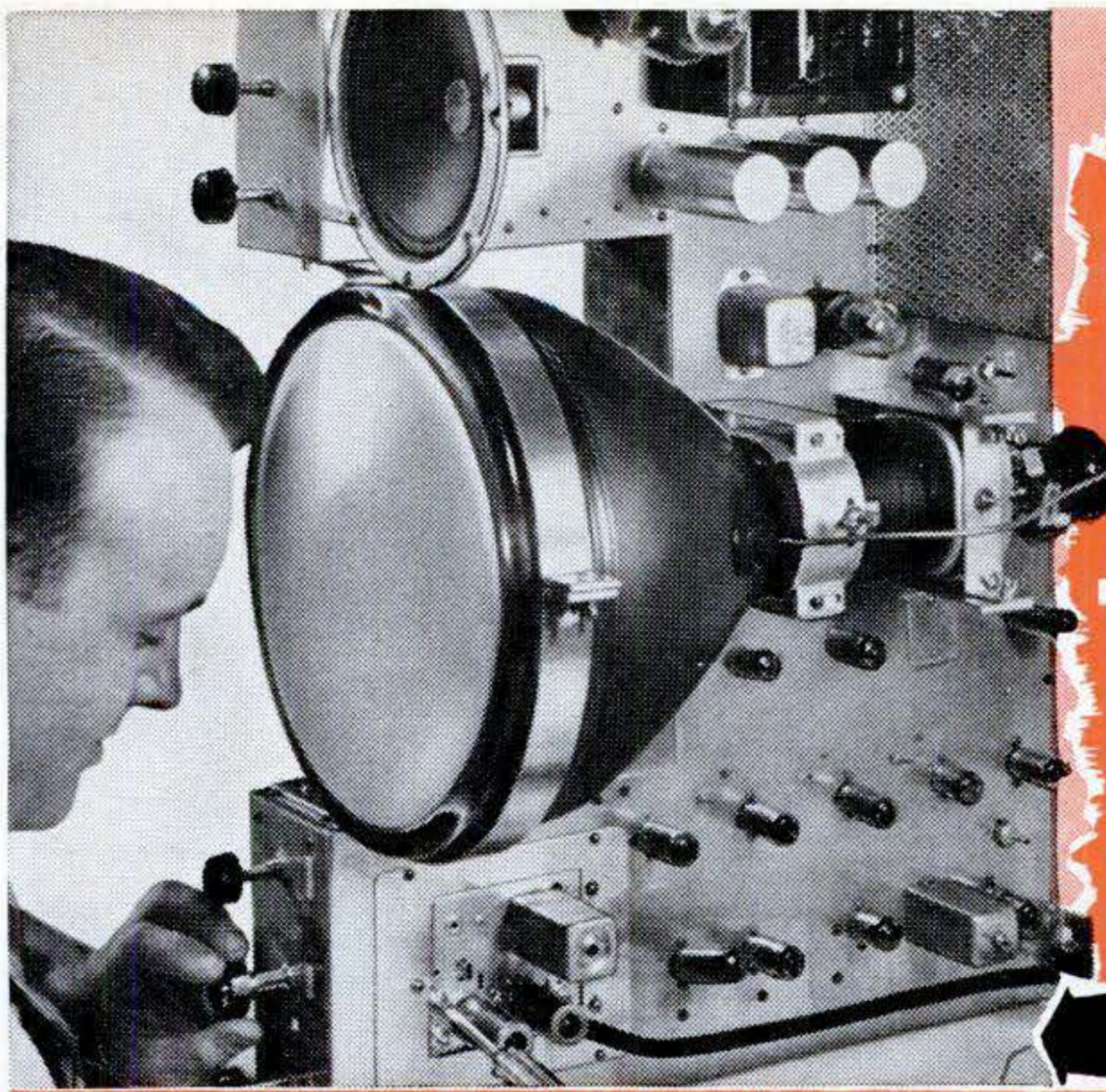

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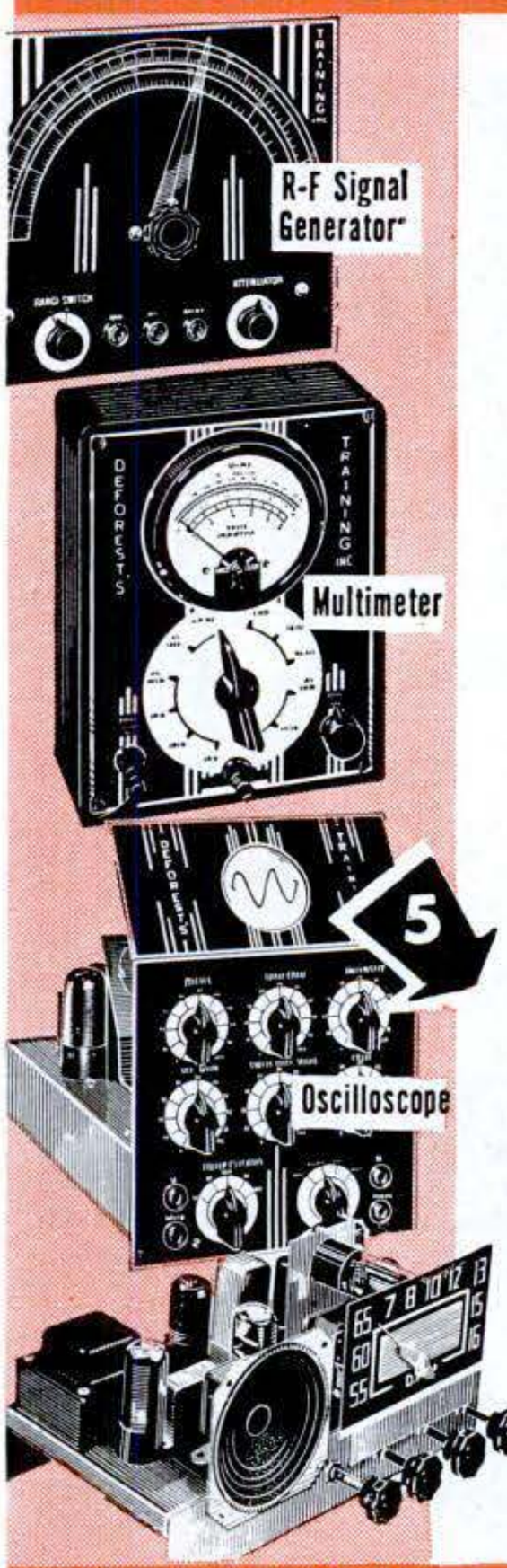


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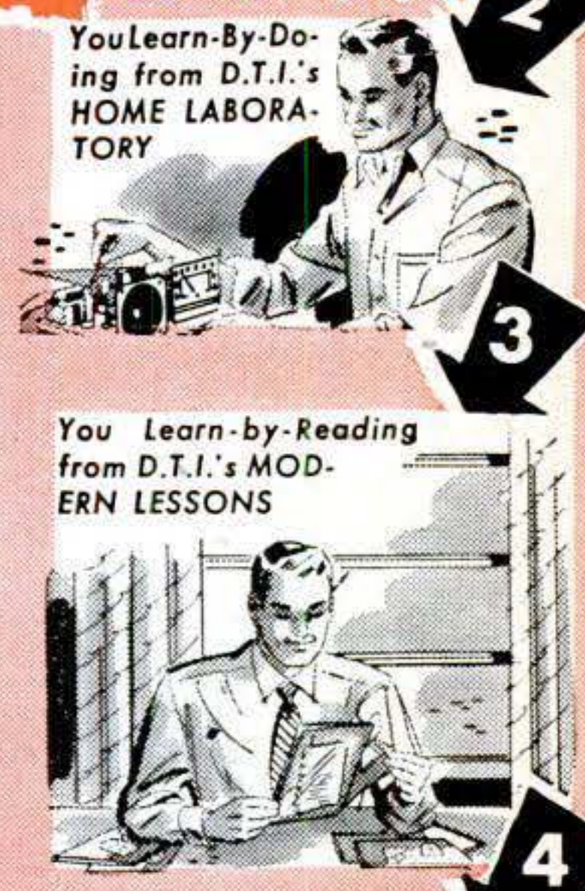

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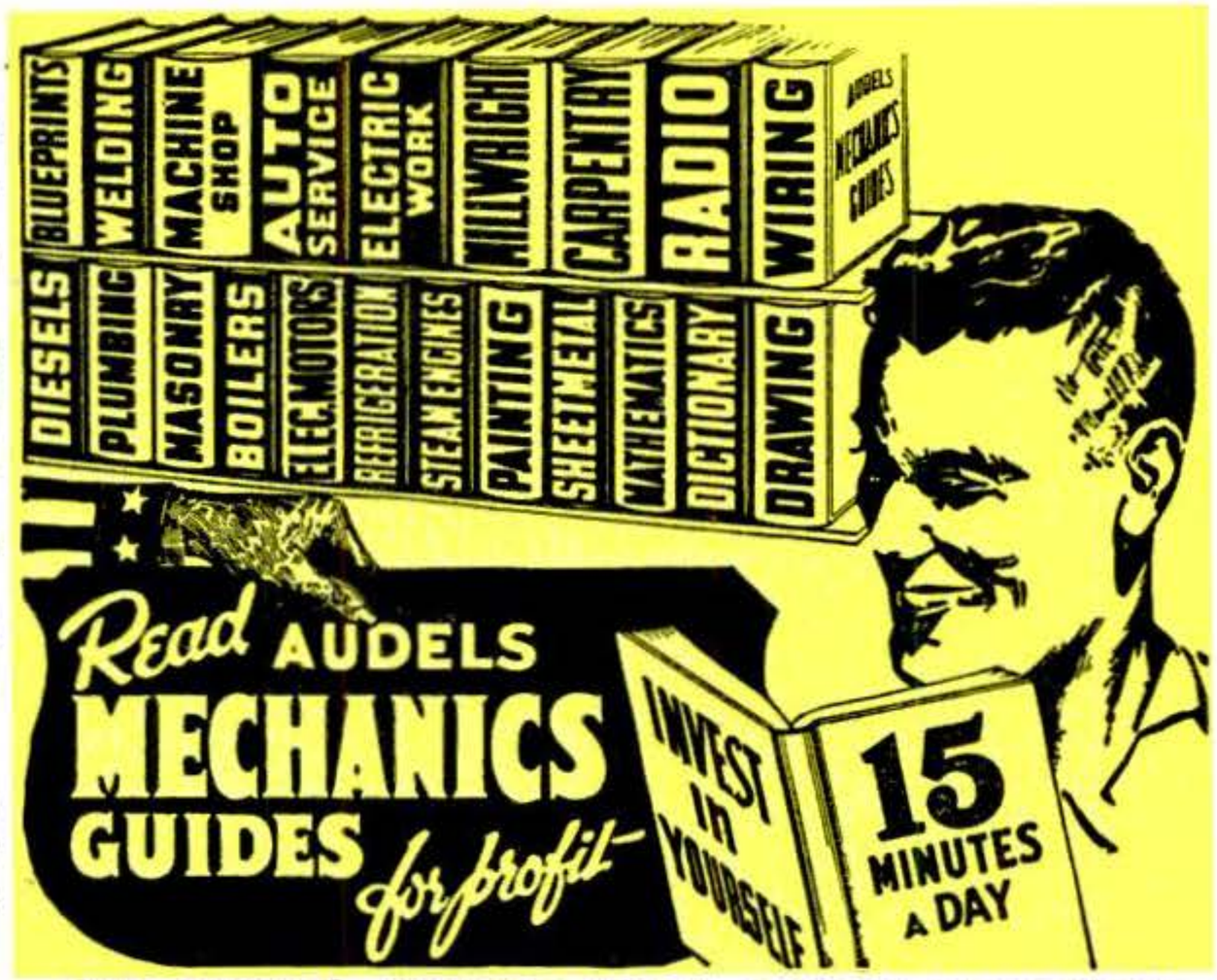


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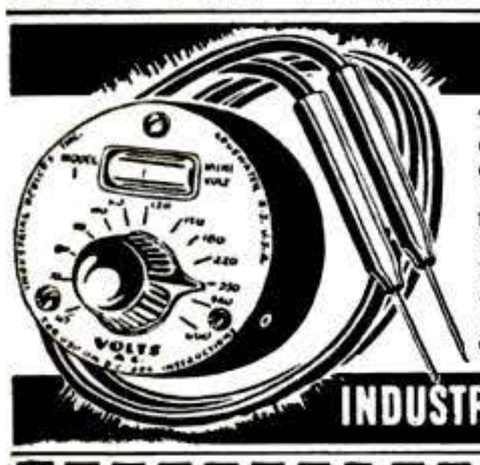

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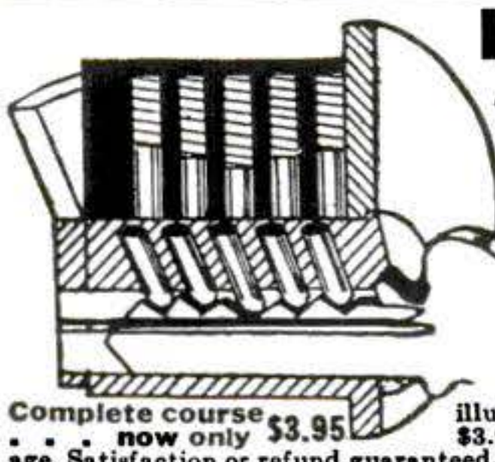

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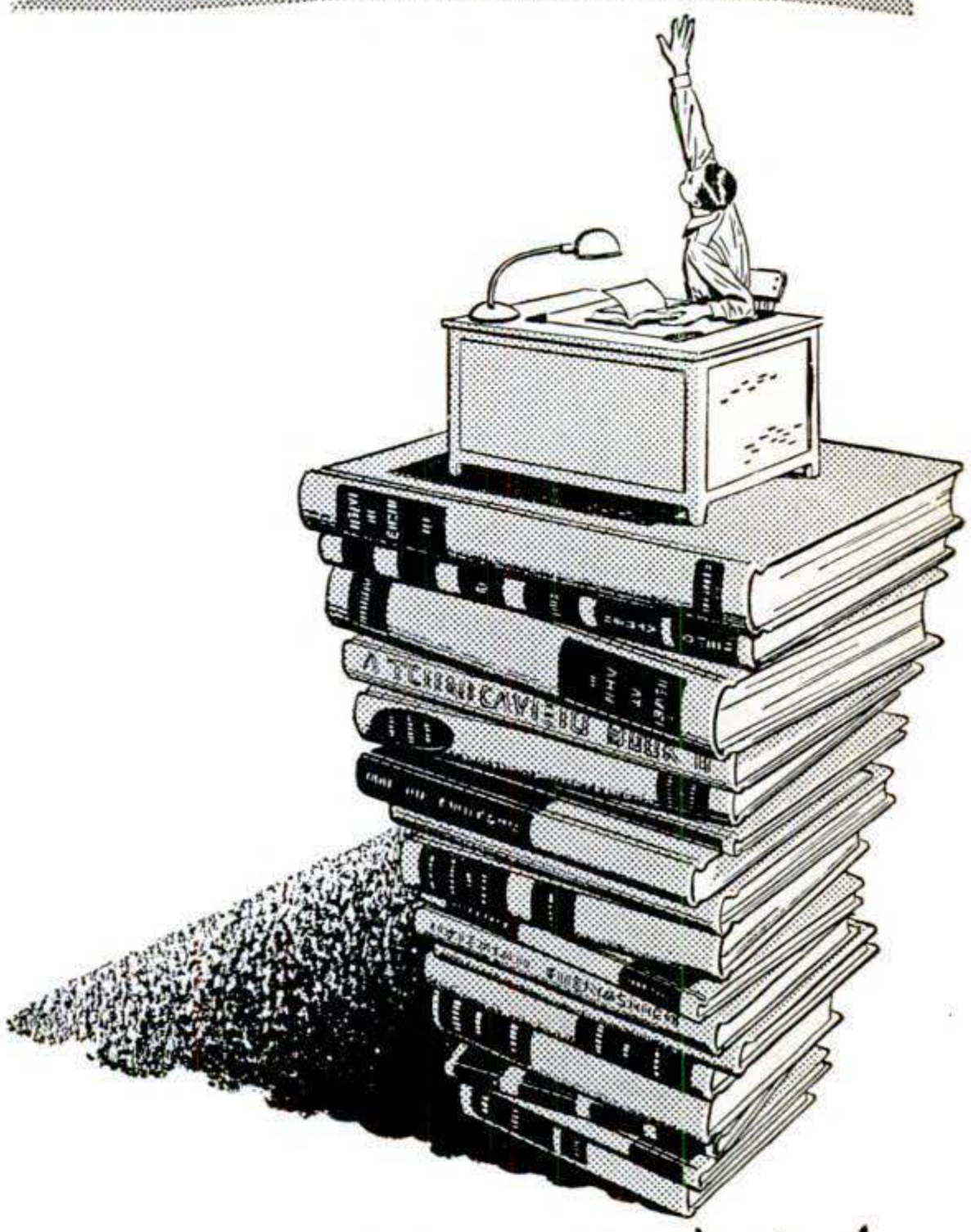

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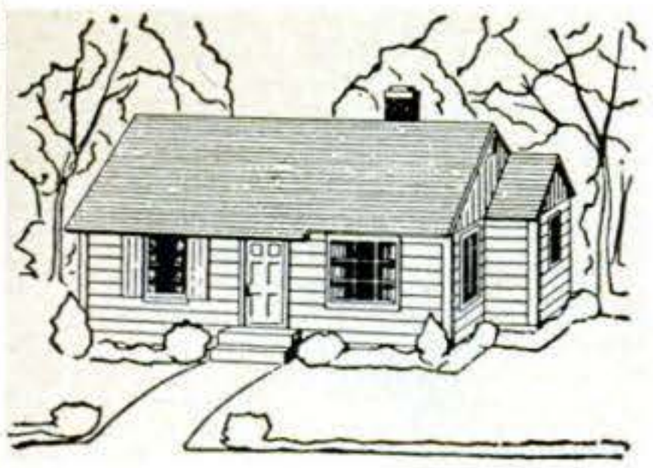

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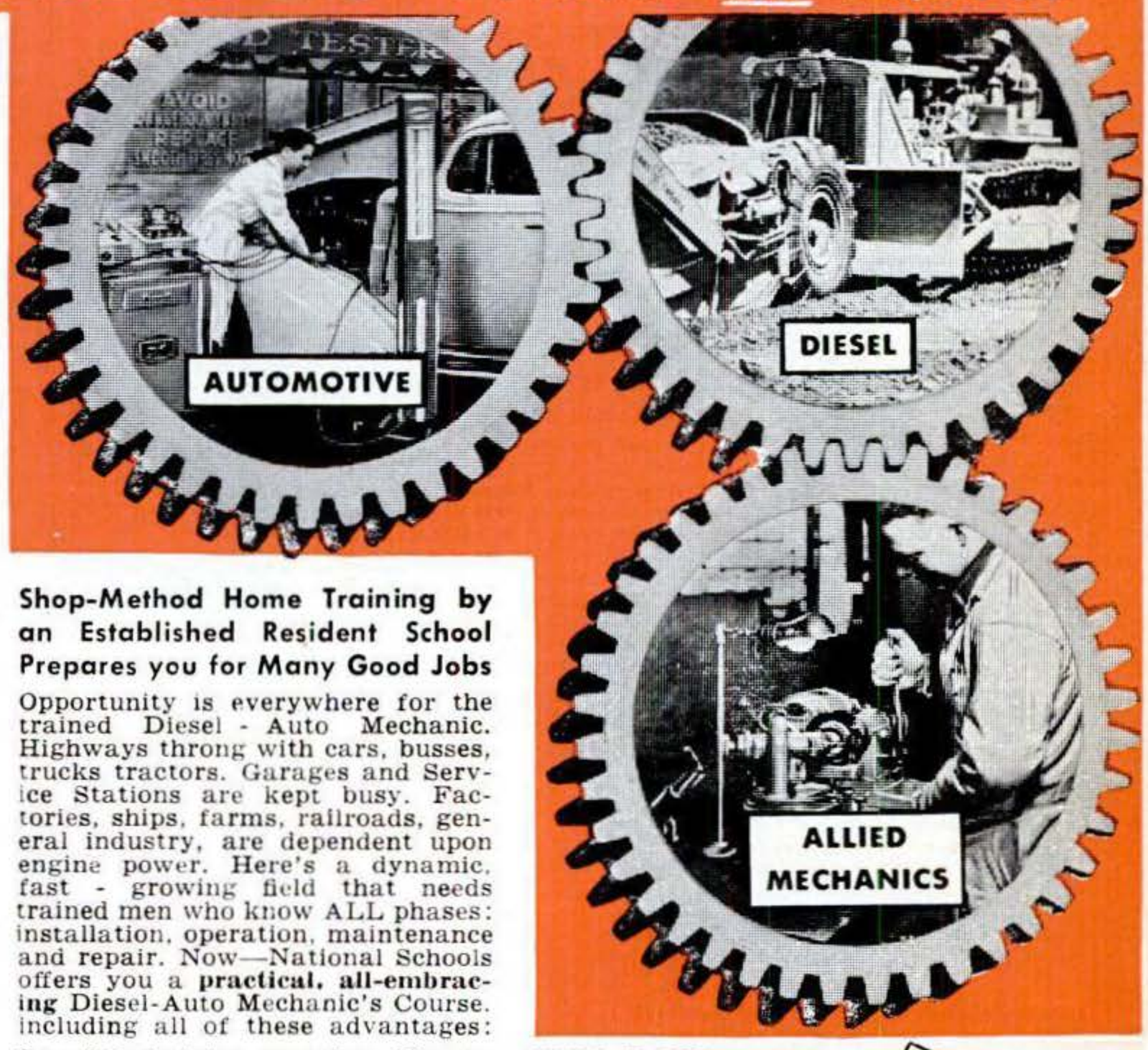


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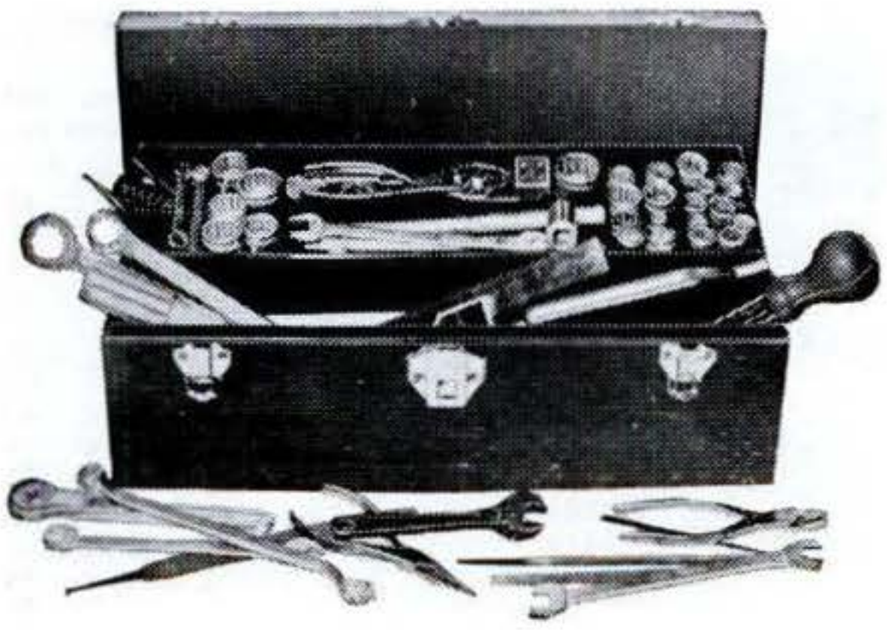

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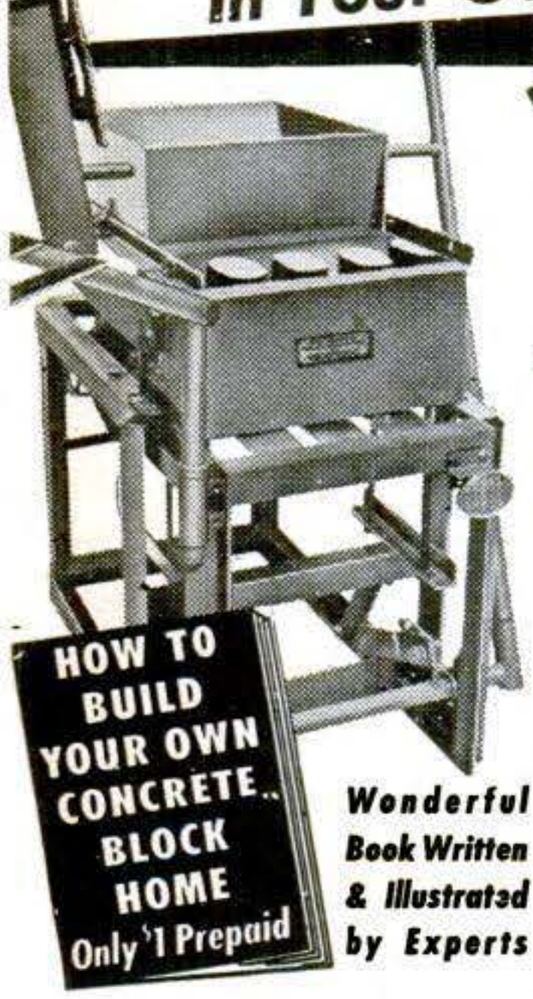


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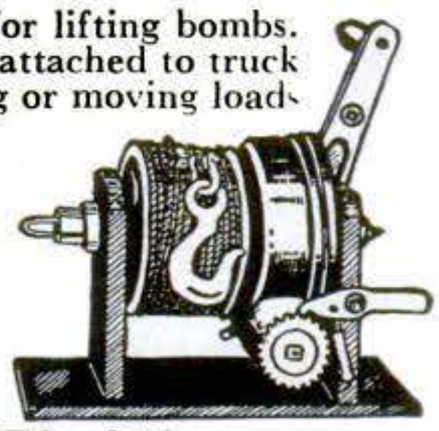

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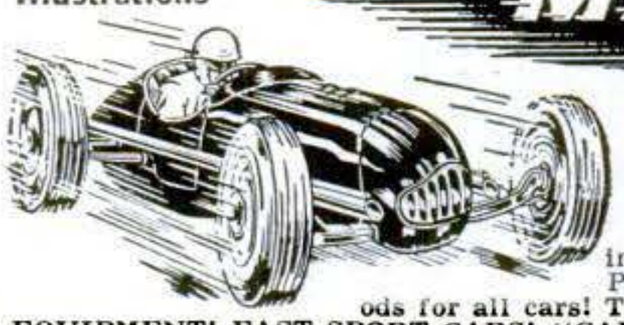

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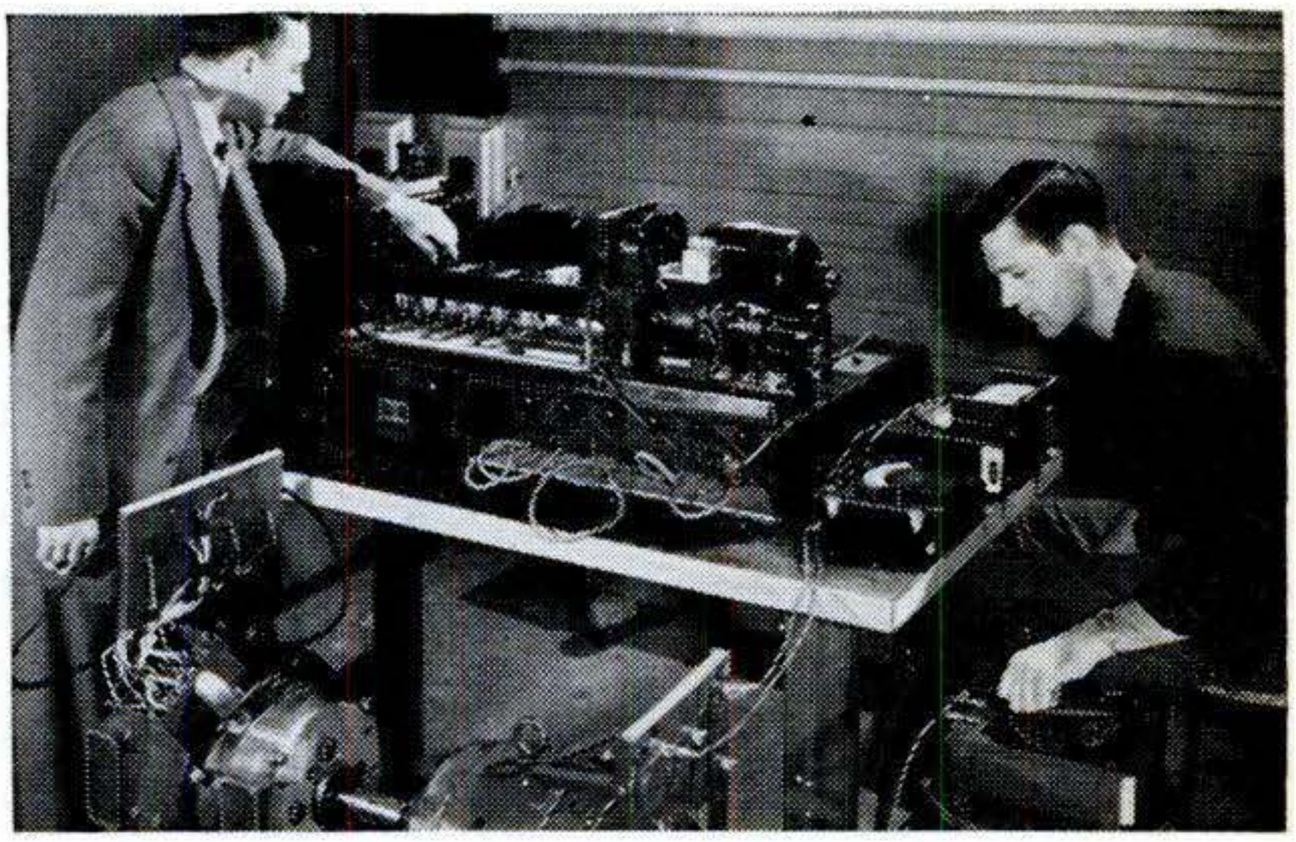

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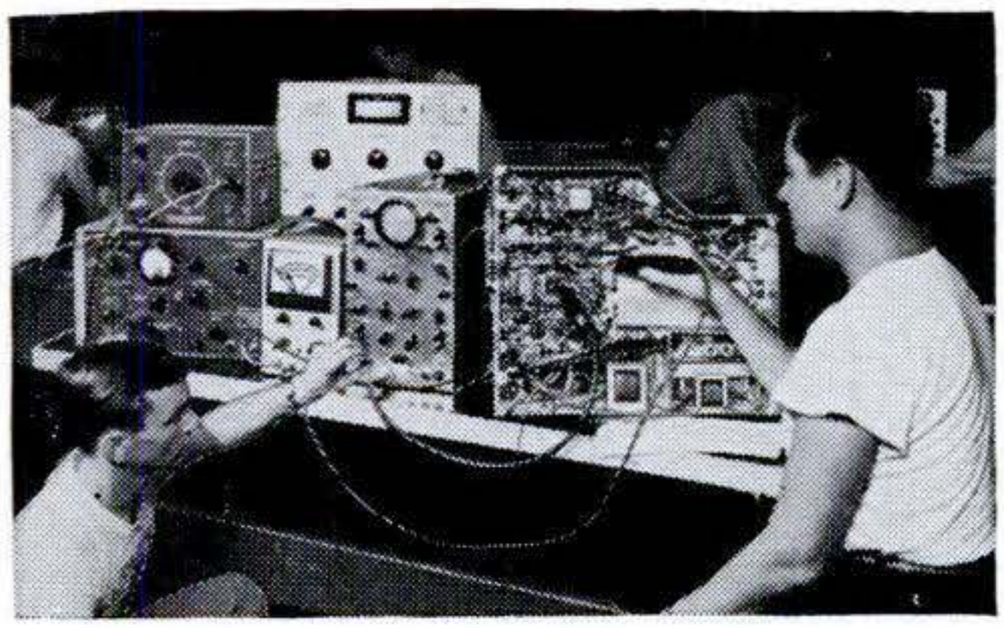

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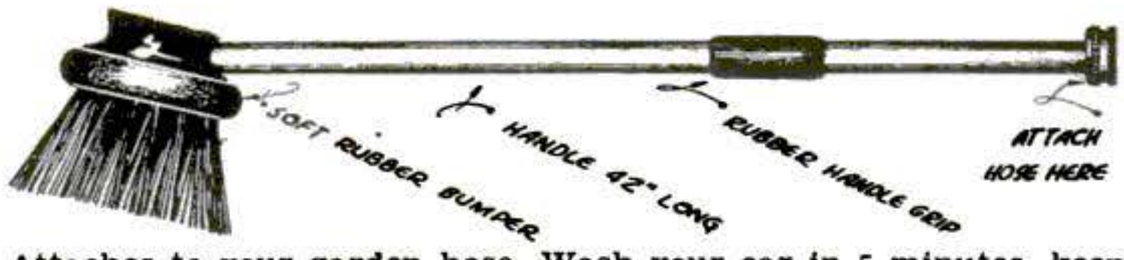


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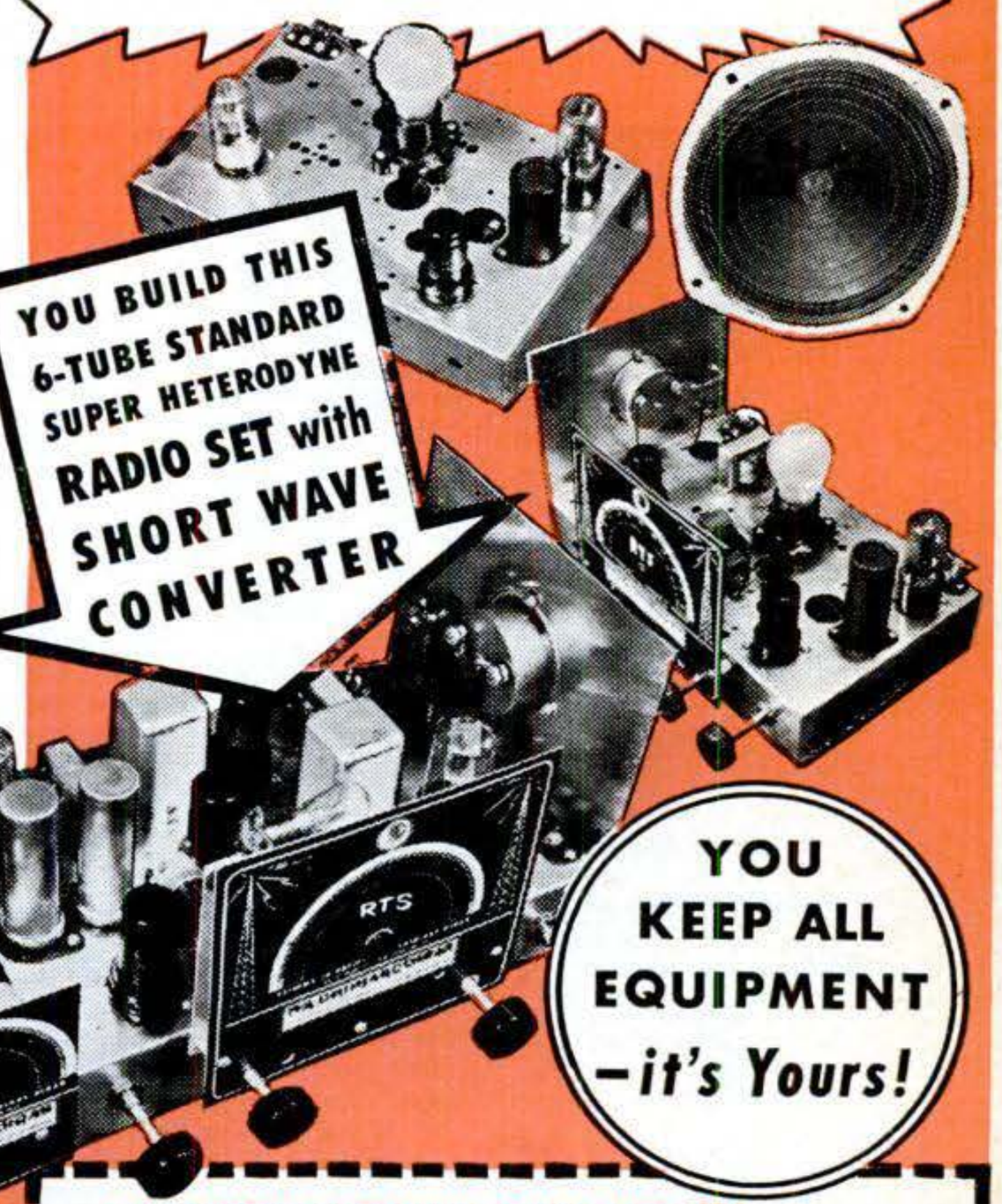

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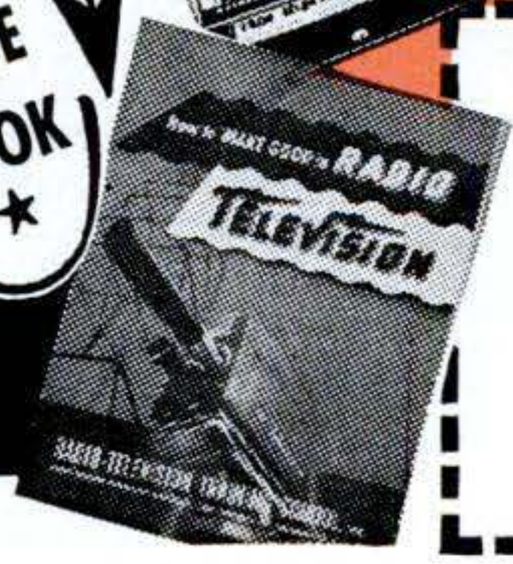


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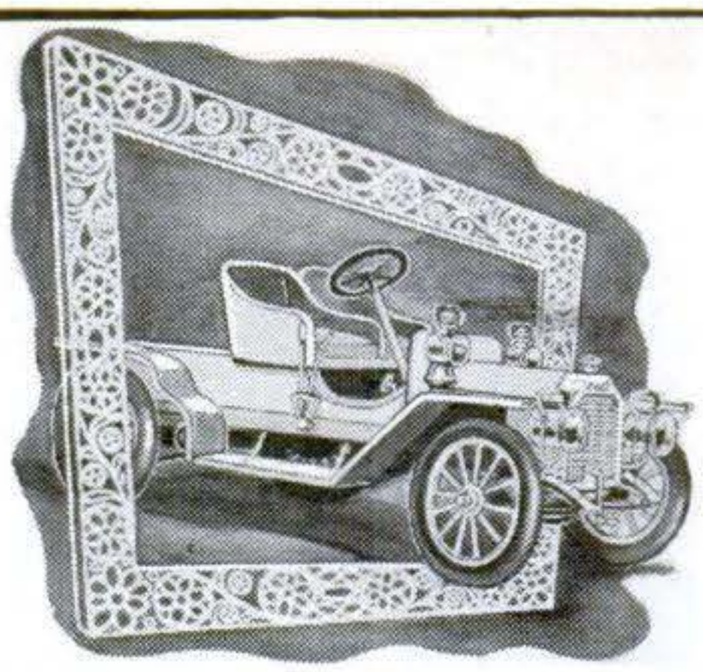

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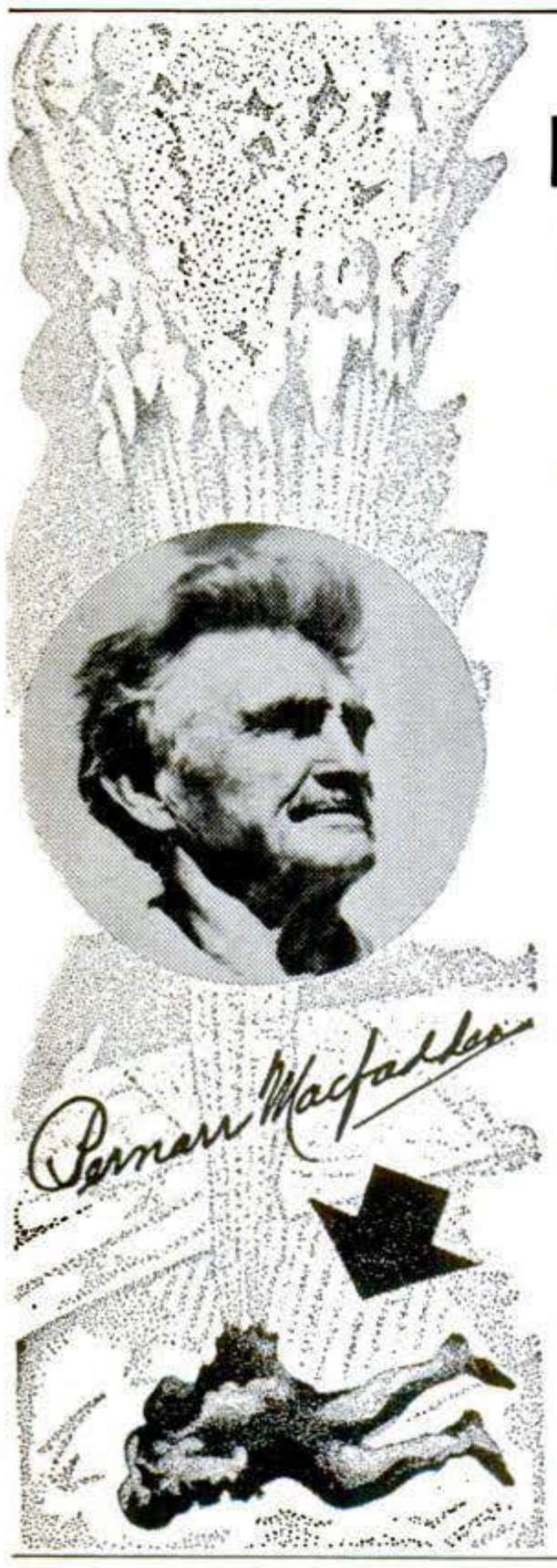


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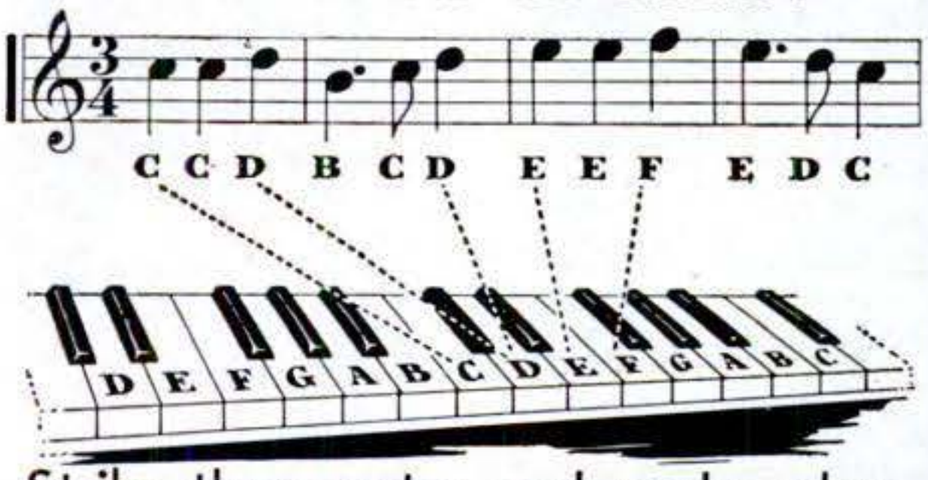


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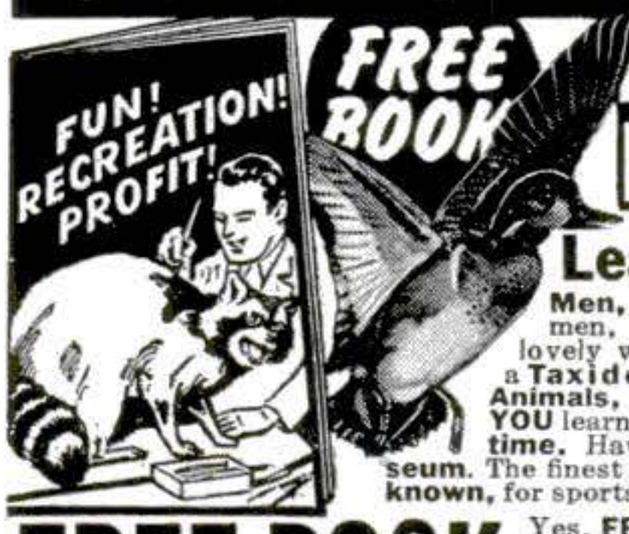


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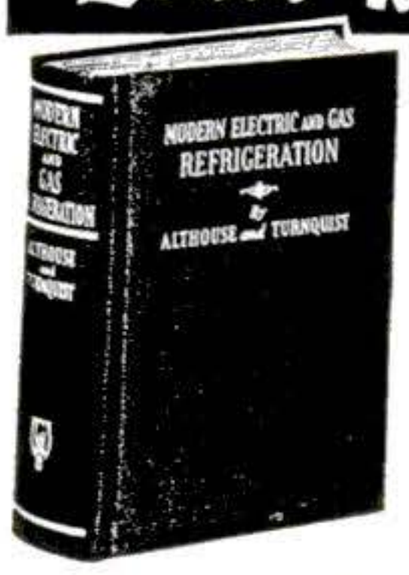


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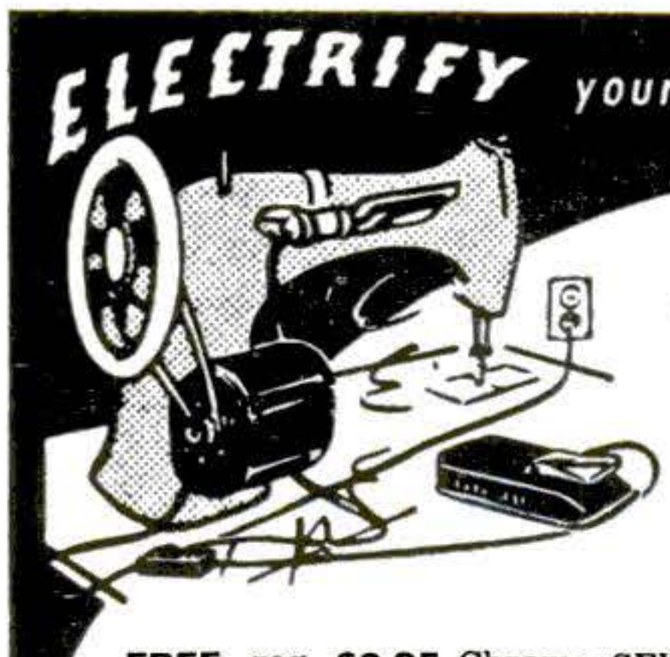

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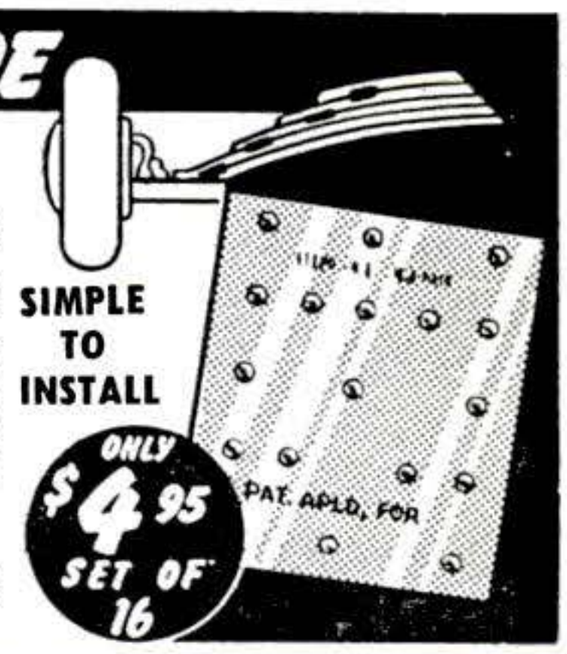


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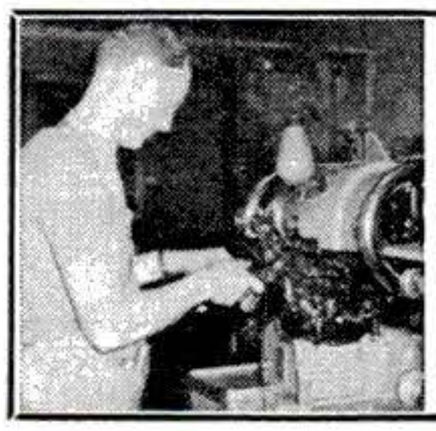

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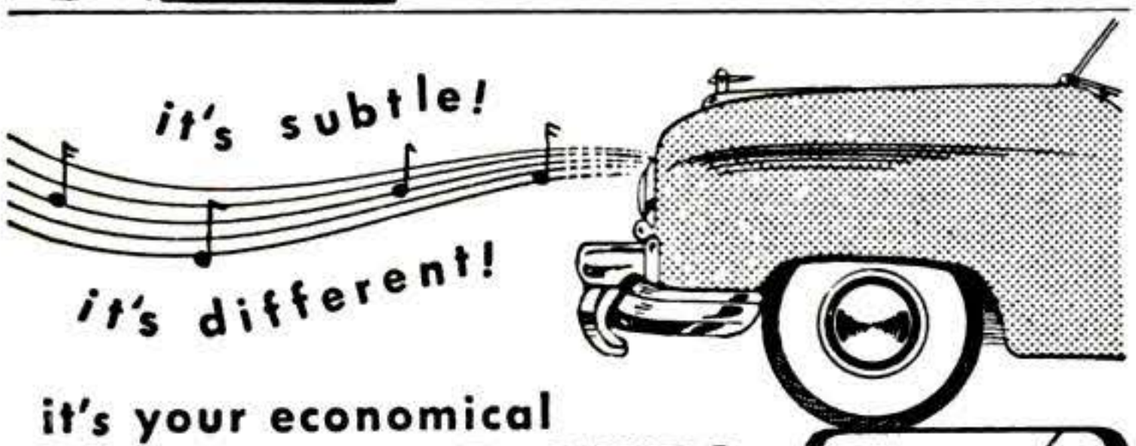


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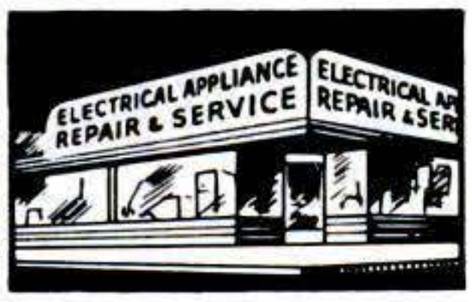


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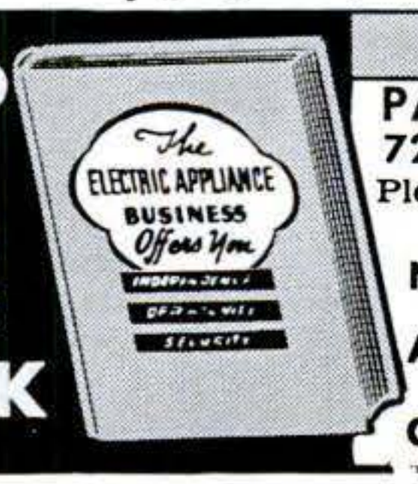


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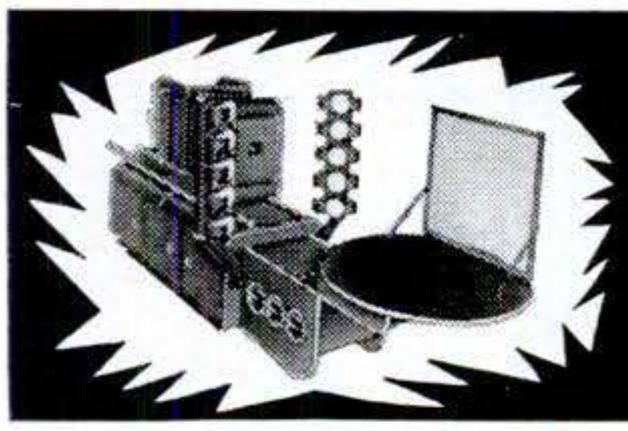

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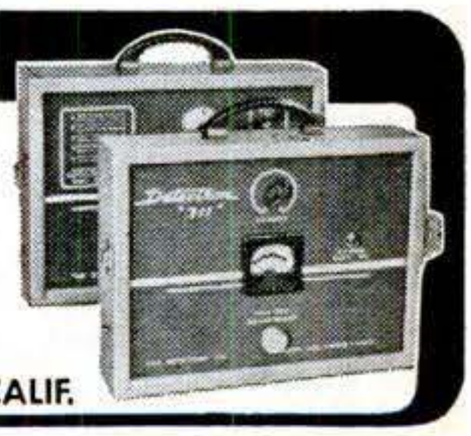

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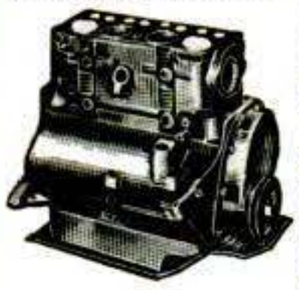

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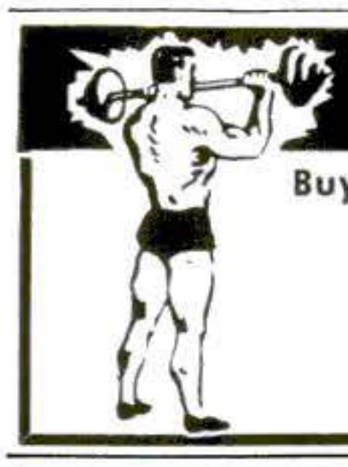

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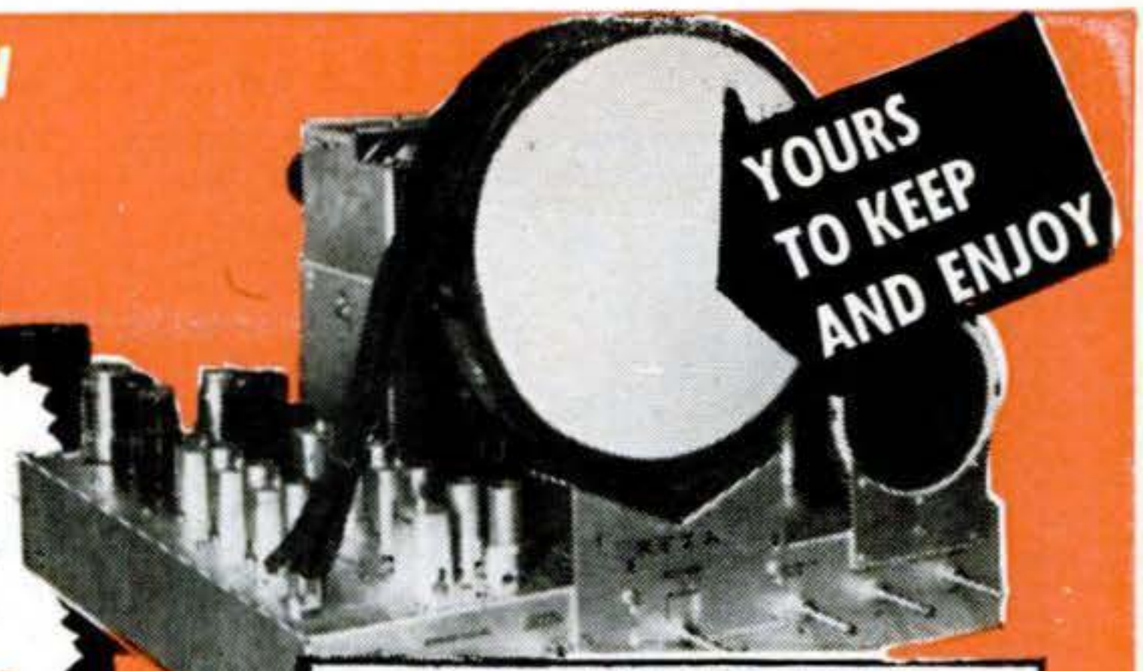


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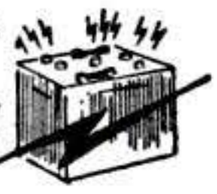

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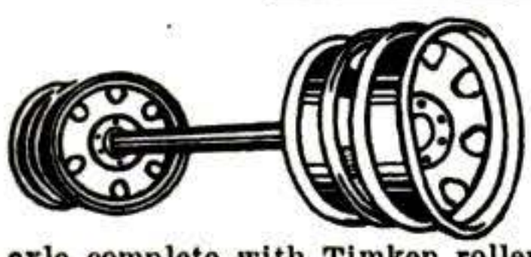

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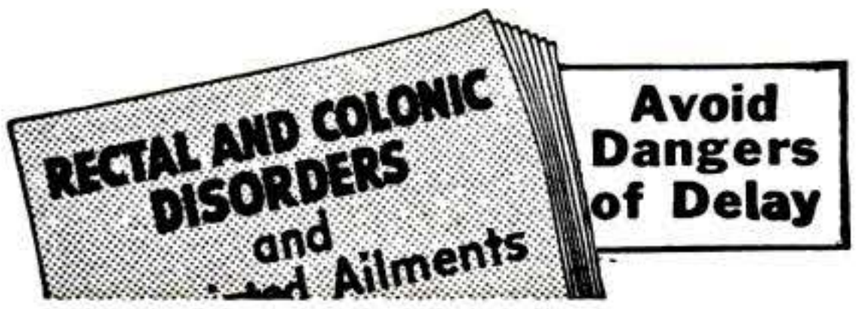


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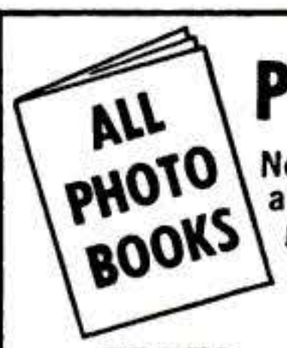


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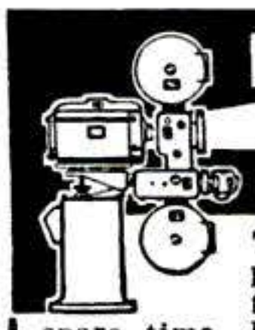

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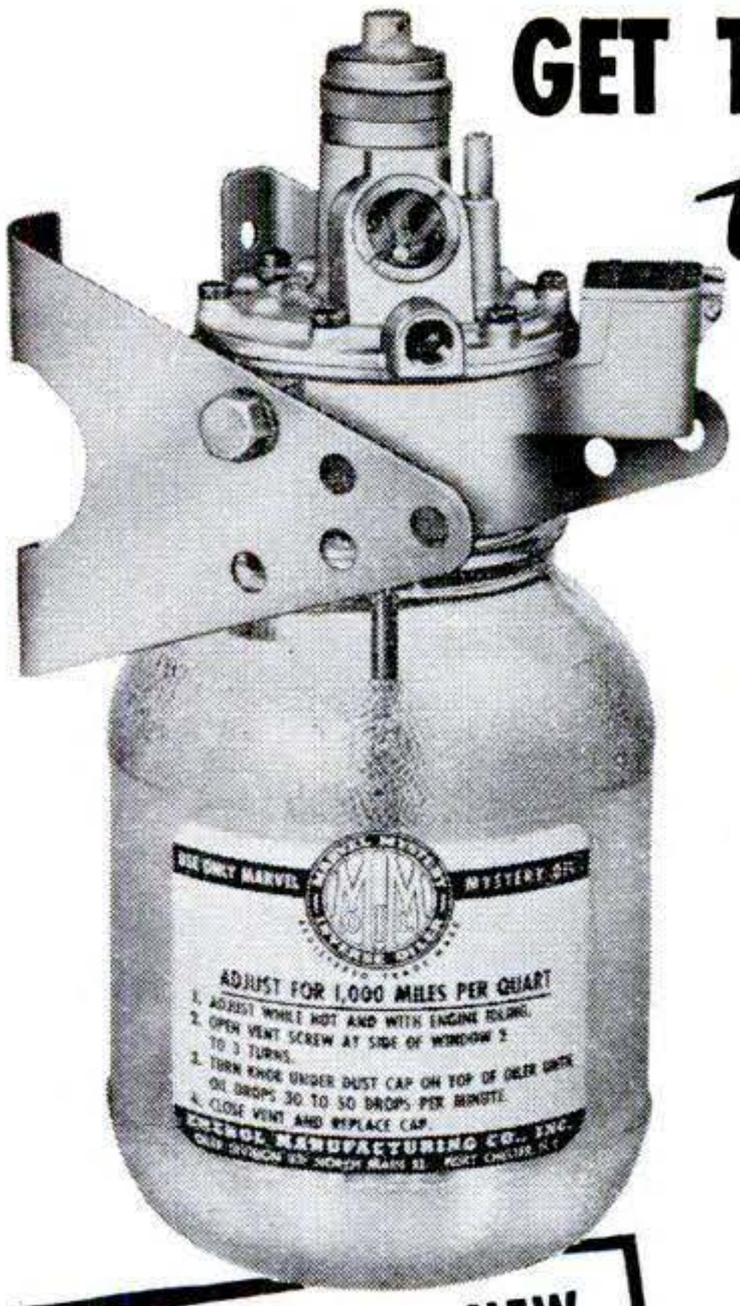


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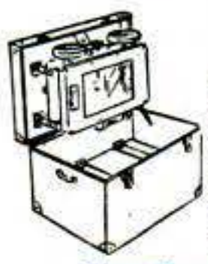

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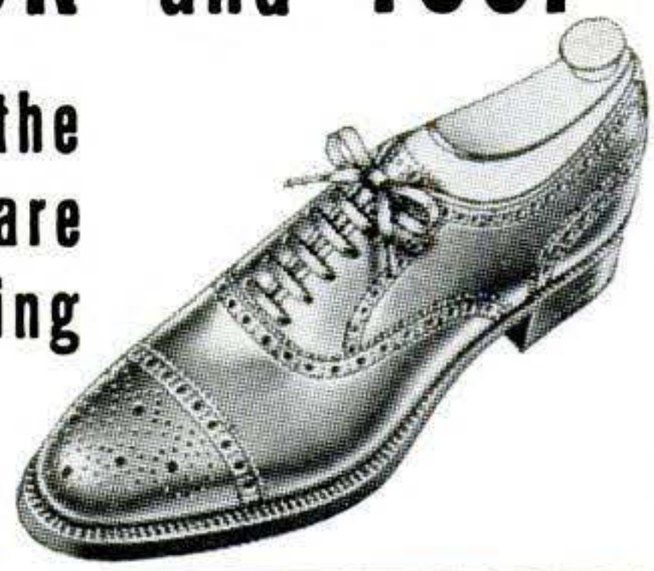

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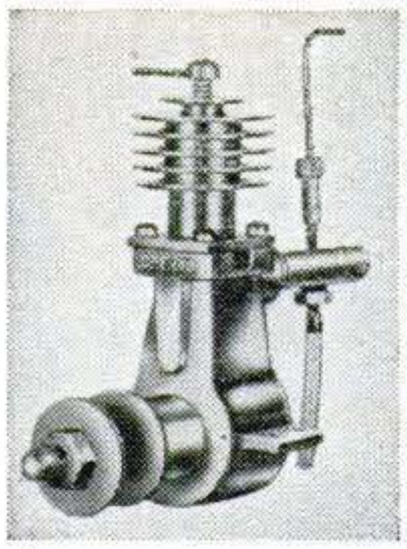

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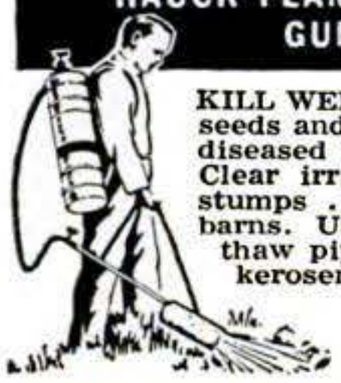

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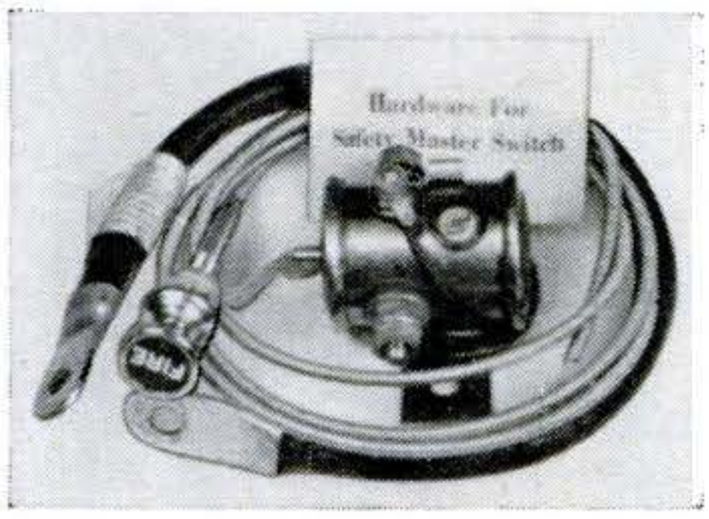


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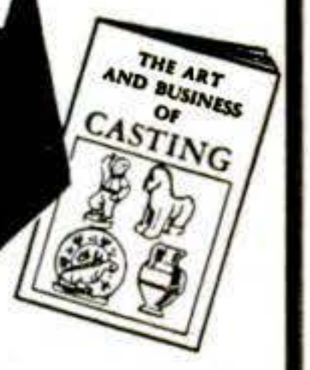


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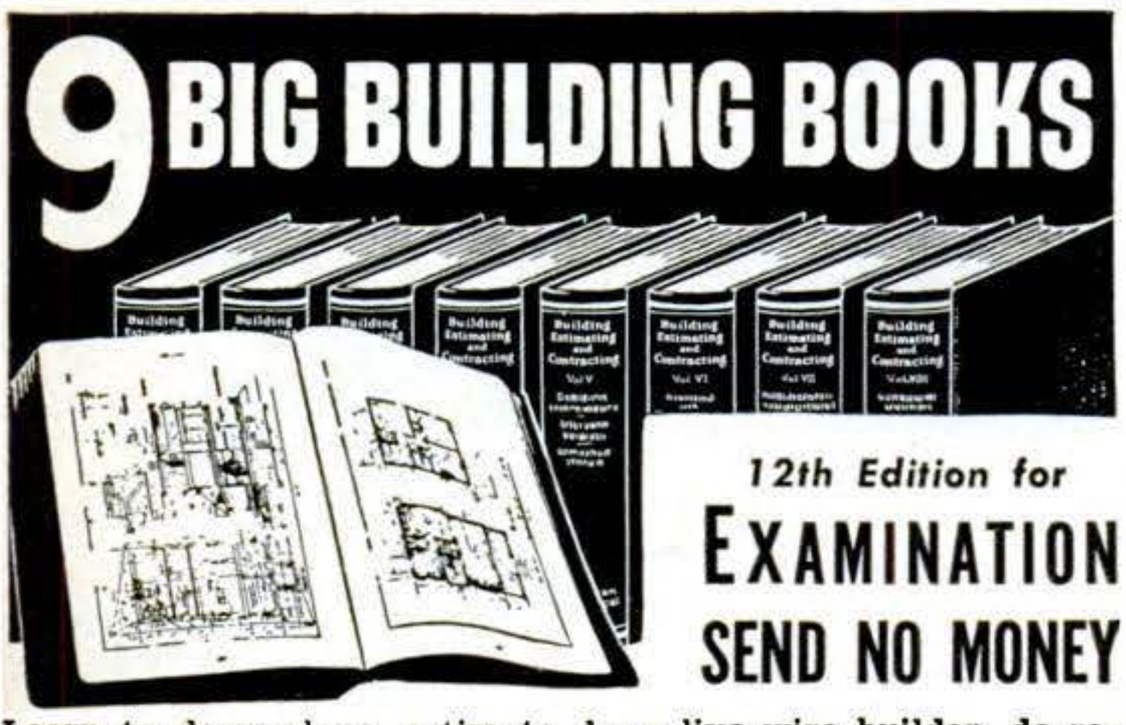

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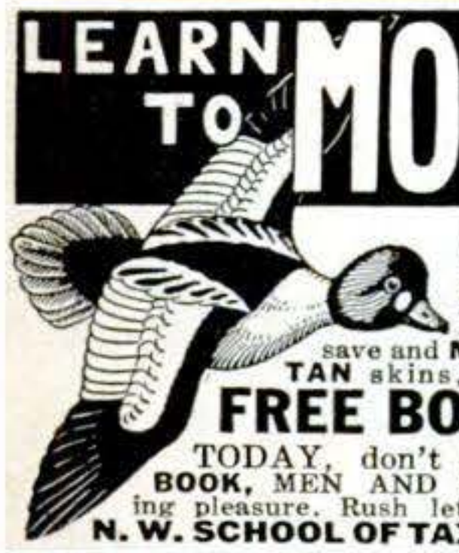

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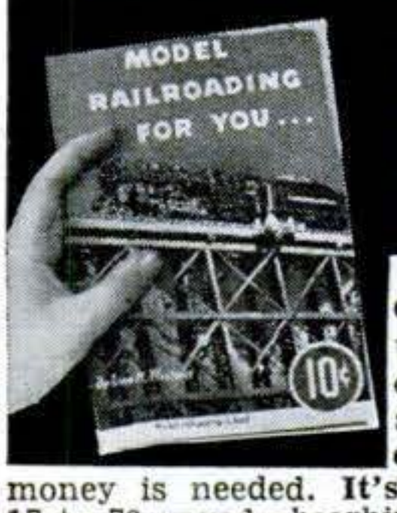


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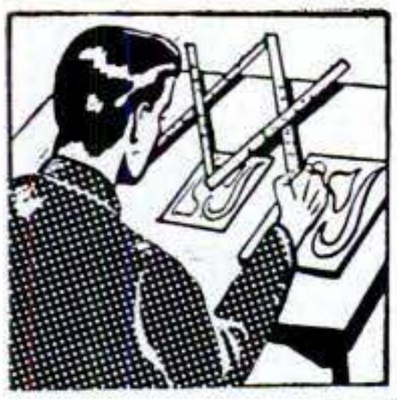

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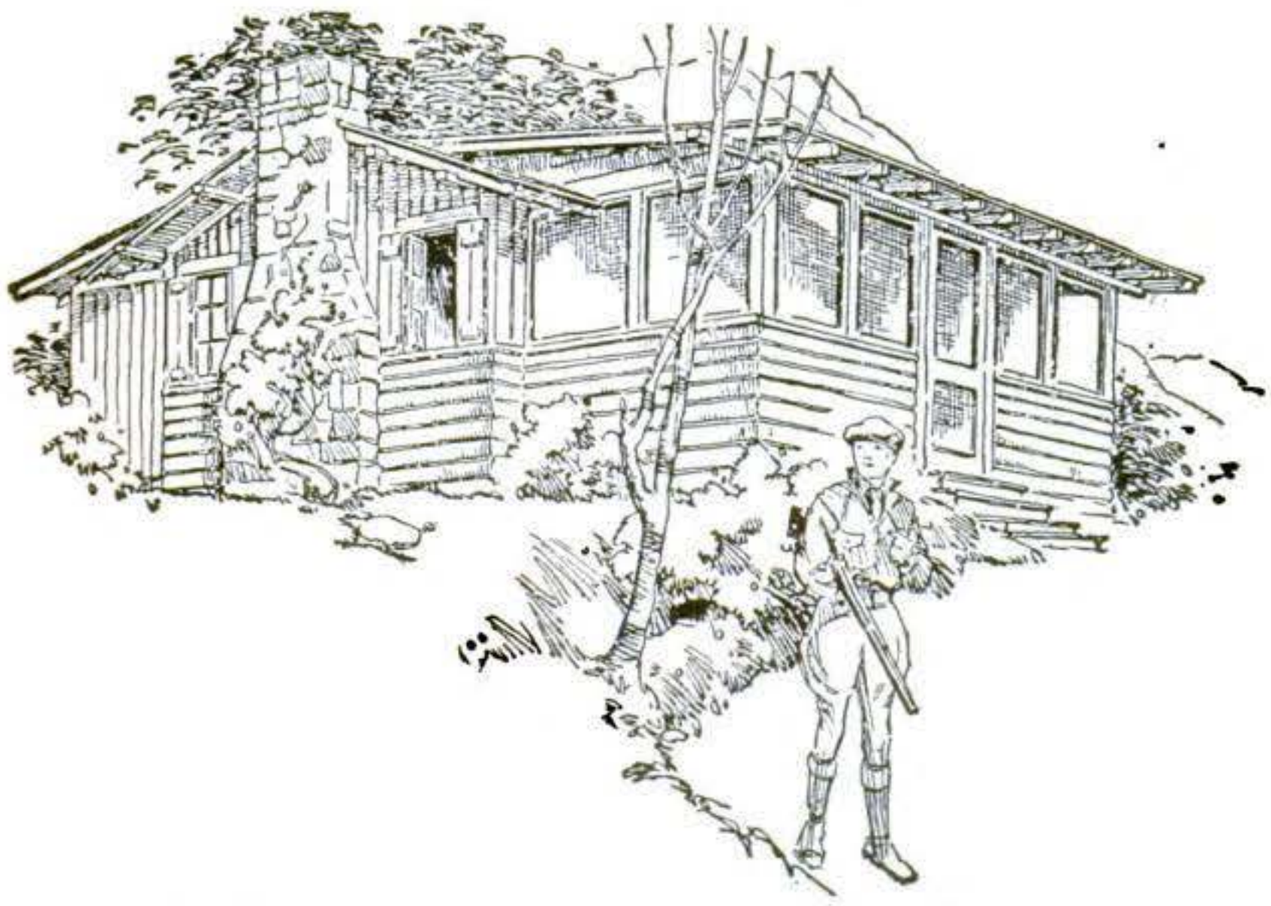

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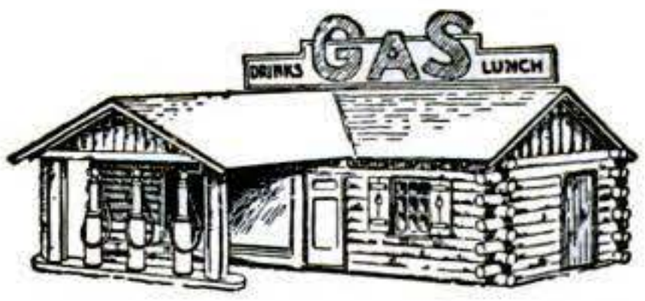


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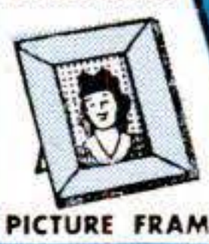

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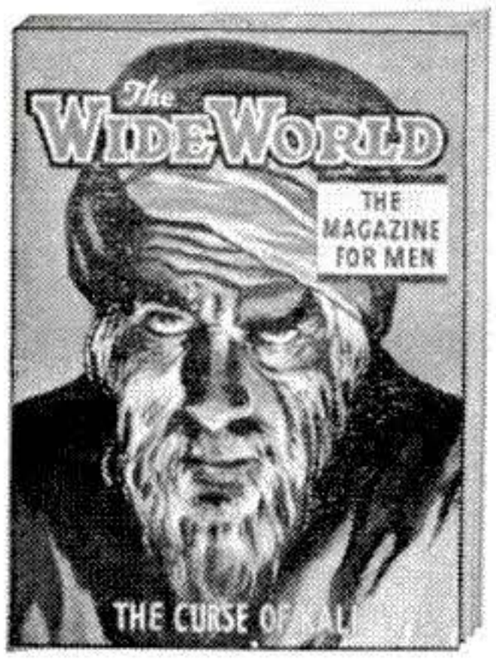


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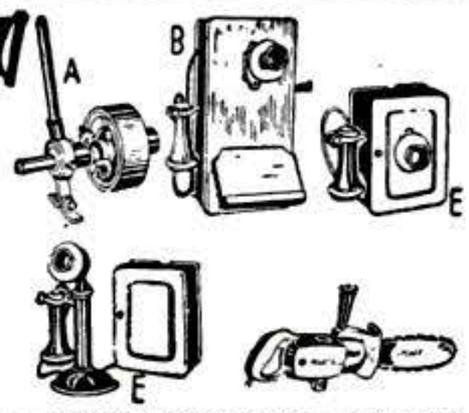


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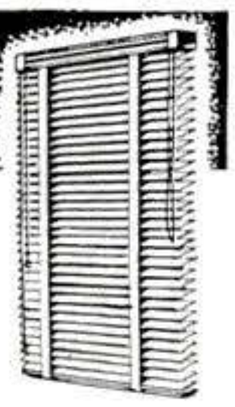

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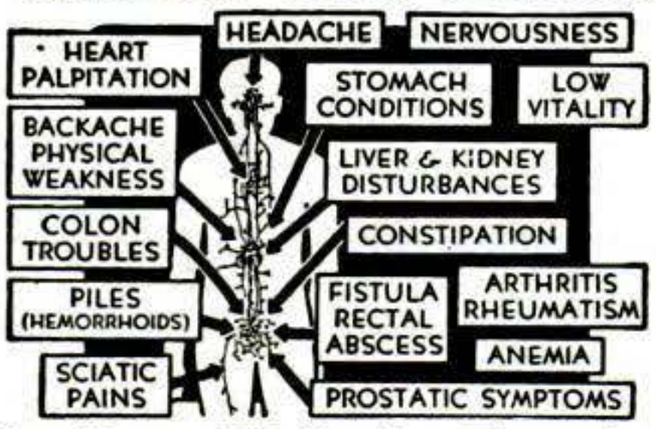


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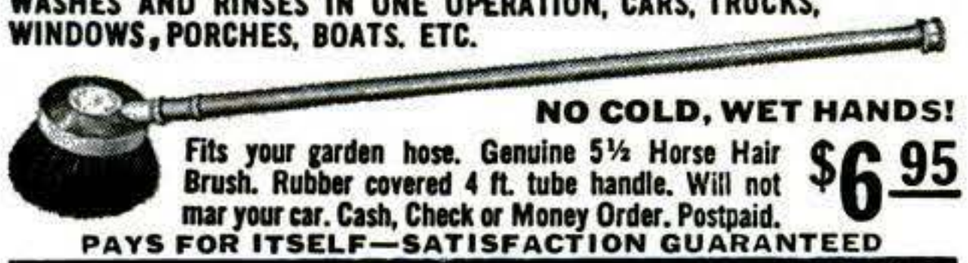

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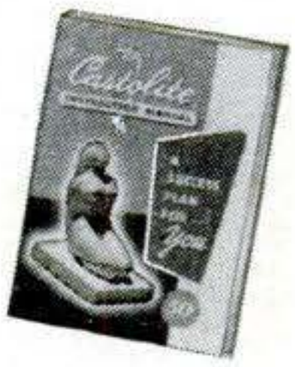

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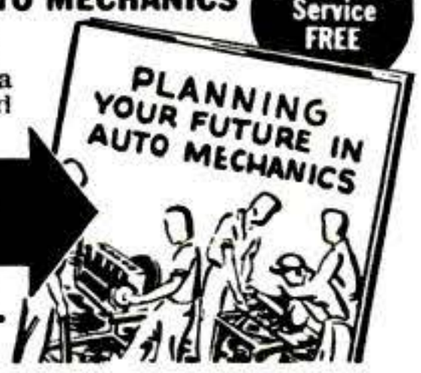


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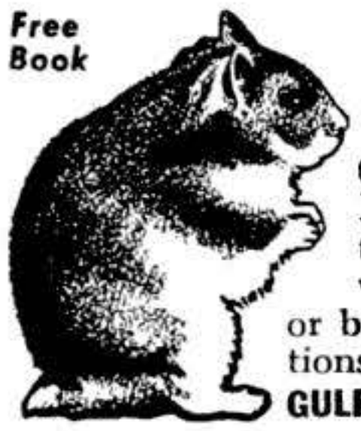

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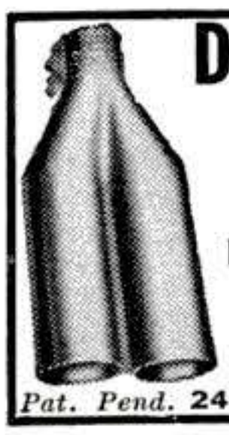

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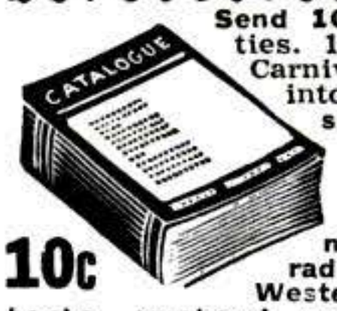


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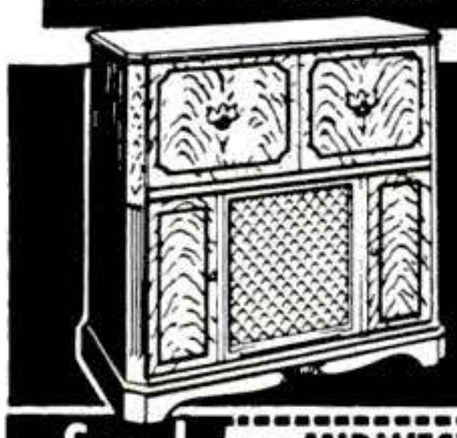

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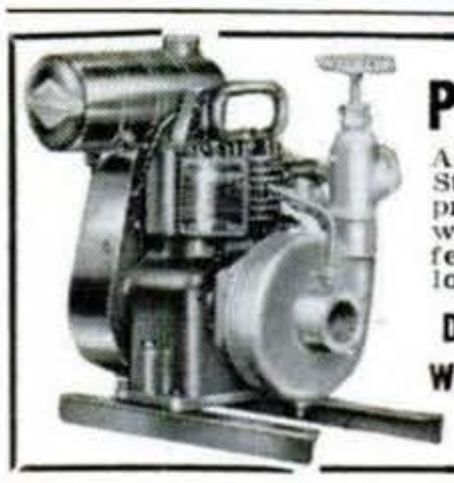

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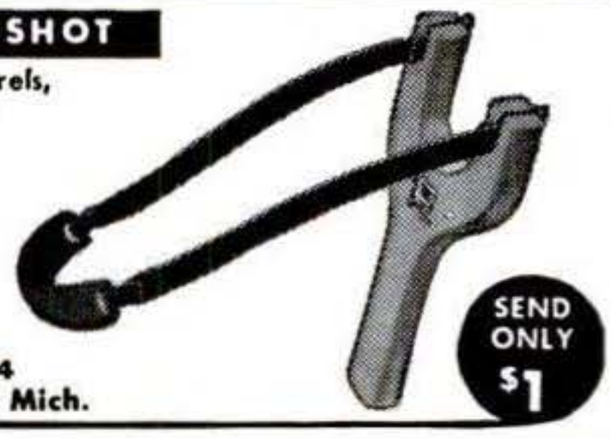

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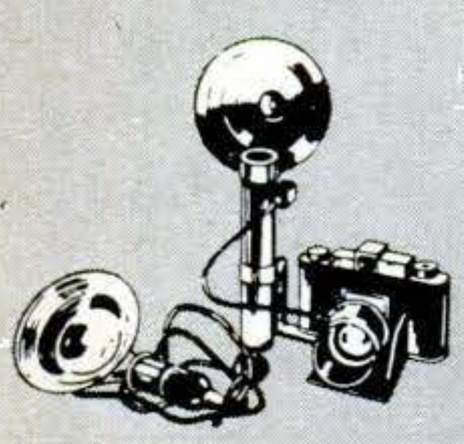

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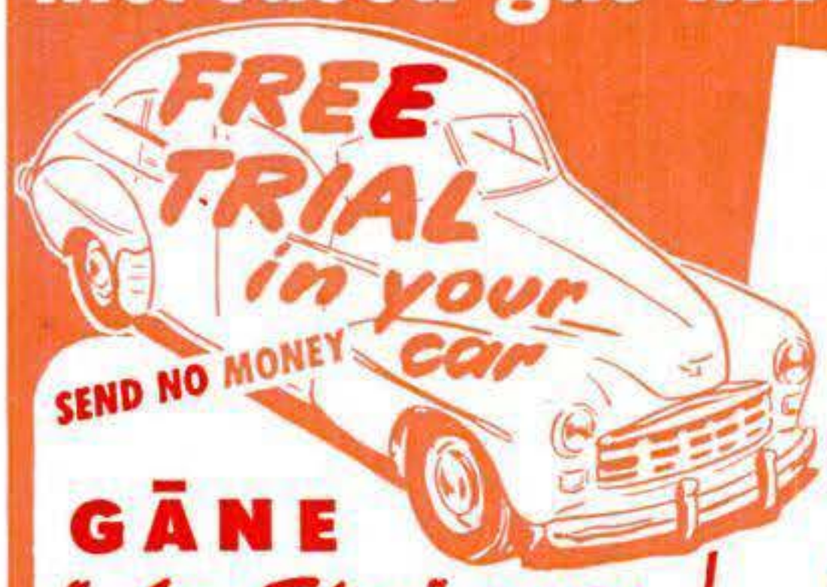

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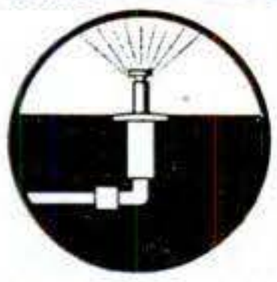

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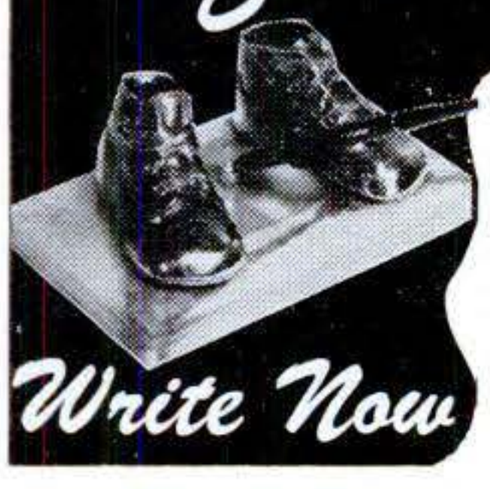

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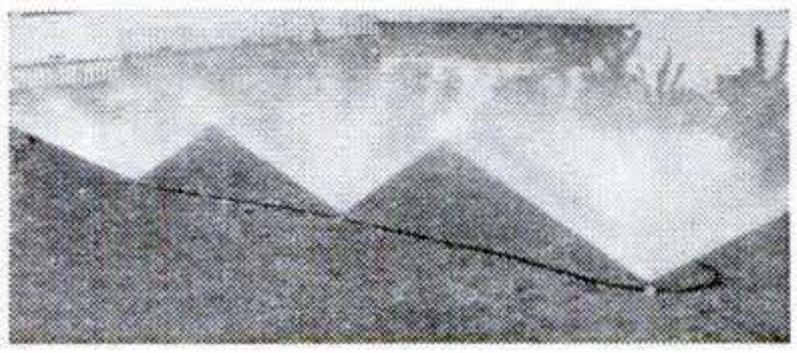

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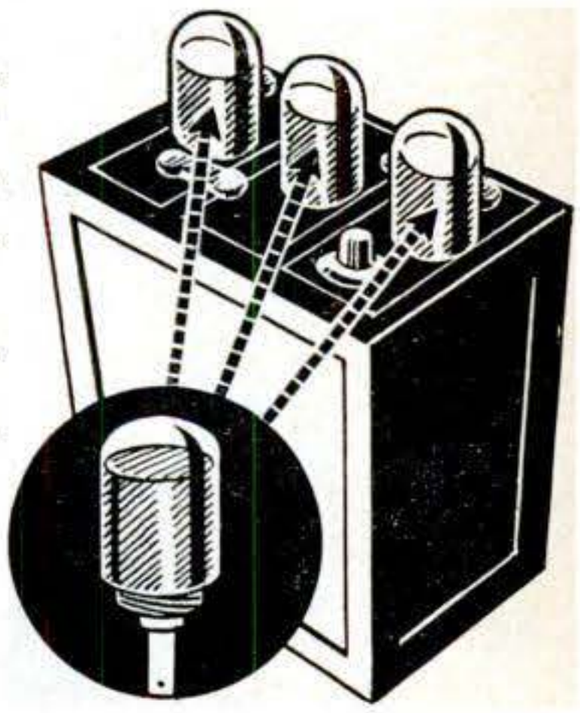

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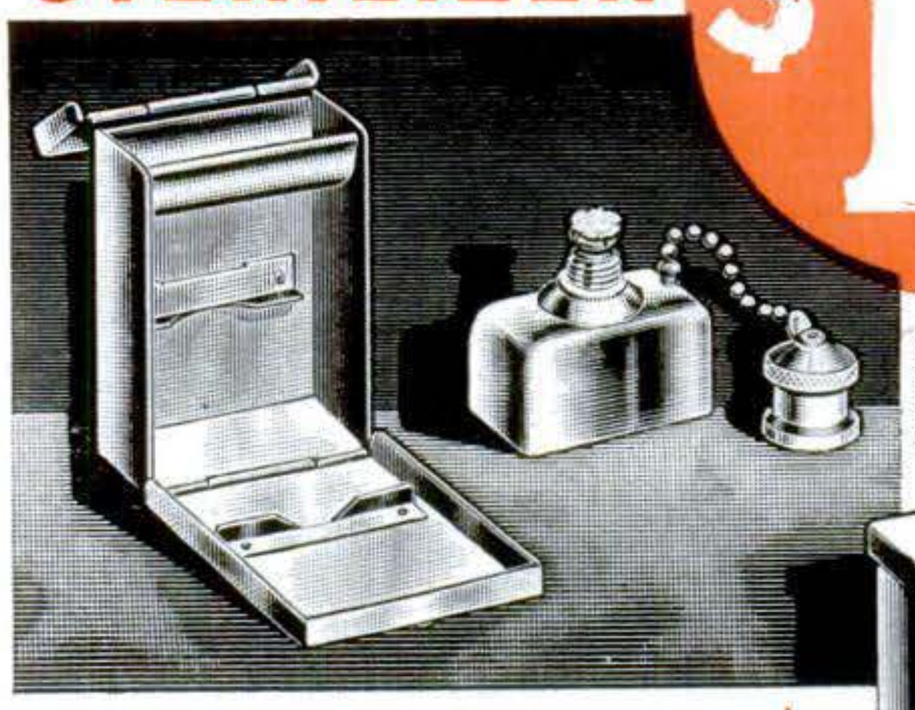

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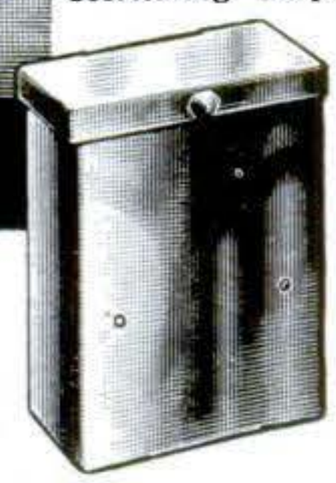

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- For repair work of all kinds
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YOUR own profitable home business. Preserve live flowers to last forever. Spare or full time. New discovery—simple—fascinating. No experience necessary. Send $2.00 for working equipment, instructions and valuable sales plans. Satisfaction guaranteed or money refunded. Hermansen, 210 Fifth Ave., Suite 1102, New York 10. N. Y.

LIKE to Make Extra Income at Home? Proven Mailorder Plans Show How. Free Details. Perry Publications, Wenatchee 2. Washington.

WANT a Mailorder business? Avoid mistakes by reading "Mailorder Pitfalls." Send for free circular. Better Sales Co., 2139 Clifton. Cincinnati. Ohio.

BIG Money Regraining-Refinishing Automobile Dashboards—Garnish Mouldings. Write Outman. 4323 So. 38th. St. Louis.

WOULD you pay 3%—first $350 made? Booklet "505 Odd, Successful Enterprises" free! Work home. Expect something odd! Pacific B. Oceanside. Calif.

EARN money at home: full, part time. Publist. Box 2160. Seattle 11. Wash.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write; Woodart, Bridgewater. Massachusetts.

WHERE to buy 500.000 articles wholesale. Details free. Krueger. 3418B Wolcott. Chicago 13.

MAILING postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordon Publishers. Box 23. Pawtucket. R. I.

"HOW to build your own Mail Order business" Idea booklet for beginners. Mail Dealers tells how to use tested, workable, profitable plans. Send 25c and "Know How." Satisfaction guaranteed. Ludecke. 5809-A Franklin Ave., Hollywood. Calif.

RUBACREAM! Natural latex cream! Makes molds quicker! Thicker! Free sample convinces! Castcraft Studios. 2027-S Fulton Street. Brooklyn 33. N. Y.

MAKE Perfume. Men, women. Write Carey Laboratories. 1914 Chouteau PS4. St. Louis 3. Missouri.

OPERATE Mail Business. Details free. Acheson. Box 23. Boston 17. Mass.

SENSATIONAL new plastic clock kits. Keep perfect time. Big Profit. Send $3.00 for sample postpaid. Fred. Mfg. Co., Box 262. Endicott. N. Y.

SURE cut blade. Made from special hard steel. Keeps Lawn Mower sharp. Guaranteed for years. Dealers Territories open. Write for Details. Sure-Cut-Blade Co., 2642 Elmwood Ave., Cuyahoga Falls. Ohio.

BUY it wholesale. Manufacturers. Distributors offer 850.000 items. Literature free. Olsen. 1231-B East Third St., Duluth 5. Minn.

FREE Folio. 700 Money making deals. Plans. Formulas. Supply Sources. Kolamite Company. Box 572. Dayton 1. Ohio.

WHY Job Worry? Start Electroplating. Metal Finishing Business. Free Booklet. Trade Secrets. S. Hyde. 327 West 120th Street. Los Angeles 61. California.

POPCORN poppers, peanut roasters, copper candy, caramelcorn kettles. Northside Co., Indianola, Iowa.

ELECTRICALLY inclined Men. Average $50 Weekly working few hours daily. No Selling. Sensational Opportunity. Write. Manhattan. Box 6. New York 35. New York—Dept. S.

BETTER jobs in plating. Free details. Joseph Kushner Electroplating School. Stroudsburg. Pennsylvania.

MAKE $100-$250 weekly installing, maintaining fluorescent lighting. Rebuild fixtures. Free literature. Distin. 712-B State Tower Bldg., Syracuse 2. N. Y.

$4.000.00 PROFIT in two months. No investment. Instructions 50c. Charles. 12-BAP. Norwood. Ohio.

SAWDUST. Turn it into cash. Six methods. Instructions 25c. Charles. 12-BAM. Norwood. Ohio.

NEW. sensible approach to Baby Shoe Electroplating Business. Not synthetic. Not brushplating. No equipment. Details $1. Eleanor Bronze Arts. Havelock. N. C.

HOME workers; Spin angora wool into yarn. House of Angora. PSM. Springfield. Illinois.

OIL Workers. Real inside information about oil—over 300 pages—Send $2.00. Harry Walker. Lockport. Illinois.

$25 WEEKLY working two hours daily. No canvassing. No Manufacturing. Lycke. Box 2471. Cleveland 12. Ohio.

MAKE money making new greaseless doughnuts at home on electric machine. Wholesale to grocers, drug stores, cafes, hamburger shops. Send for free recipes and plans. S. Ray Company, 3605 South 15 Ave., Minneapolis 7. Minnesota.

MEN-Women! Make big money spare or full time at home. Flock and pearl finishing offers you opportunity of a lifetime. Write today for free sample and free catalog. Bing Products. 88-PS4 Broad. Boston 10. Massachusetts.

PIANO Tuning — Home Study — (15th year). Empire School. Champaign. Illinois.

PIANO Tuning taught by mail. Write Piano Technician. 708 Rawlings. Carbondale. Illinois.

HOW and where to obtain Capital? Free details. Star Service. Wapakoneta. Ohio.

FREE Kit starts you in advertising business of your own. New, exclusive. Dividend Company. Liverpool 2. New York.

QUICK Money! "Repairing Car Batteries"! At Home! Easy too! Batteryman. Grand Junction. Colorado.

START Own profitable mailorder business. "Natural" money-makers revealed! Edward Lay. 3819 Kenmore. Chicago 13.

BRONZED Baby Shoe mountings, equipment and supplies. We manufacture world's largest assortment of all metal mountings. Wholesale only. Ramyr selenium platers $49.50. Complete baby shoe plating assemblies low as $59.50. Write for Free copy of electroplating instructions. Sales Dept., Hollywood Bronze Supply. 1766-70 N. Vermont Ave., Hollywood 27. Calif.

BUY Wholesale. Big-Name Items Up To 40% Below Retail. Folks Eagerly Buy Through You To Get Big Savings. Details Free. Young's. Kent 2. Ohio.

MORE Money—Easier! Revolutionary methods make public bookkeeping easy, interesting, profitable. Earn to $5. hourly within short time! Simple, complete instructions. Full—spare time. Success-revealing information free. Auditax Systems, 10775-4 Tabor. Los Angeles 34.

## 57 MONEY MAKING OPPORTUNITIES

DETECTIVES Earn Big Money. Experience unnecessary. Particulars free. Wagoner. P-125. West 86th. N. Y., N. Y.

SEWING Machine Business Tops. Big money—not crowded. Spare time home set-up. Repair course, new machines, motors, etc., wholesale. Hurry. Taylor Service. PS. Hamilton, Ohio.

CANDLEMAKING is profitable! Detailed instruction manual. $1.00. Particulars free. Robins. 88 Sylvan Lake. Mundelein. Ill.

MAKE money repairing and building batteries. Start at home. Illustrated Manual and other valuable information. $1.00. Battery Instructions & Supply Bureau. Box 1100. Portal. Oakland 10. California.

EARN $4.00! For 10 minutes work! "Amazing." Stephens, Grand Junction, Colorado.

WANT Notary Public appointment? Official in usually 10 days. Stationers Exchange. Boerne 50. Texas.

SCHOOL Seniors—Earn 40% commission selling classmates America's Most Beautiful Graduation Name Cards. Largest selection. Outsells all others. Free sample kit. Printcraft. Dept. M, 1425 E. Elm Street. Scranton 5, Pa.

"OPPORTUNITIES Preferred Magazine" tells how. Sample 25c. Glen, Howel 5. Kentucky.

CHURCHES Women's Clubs organizations $130.00 Free. Plus card table. Easy No investments. You sell advertisements. Unique Gift Club Plan. Pine Hill. N. J.

PROFITS from Plastics Formula 50c. Gerald McNeely. Box 524. Rochester. Minn.

1.023 WAYS to make money. $1.00. J. Babcock. Box 961. Scottsbluff. Nebraska.

WIN Contest Money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests. 1609-A East 5th. Duluth. Minnesota.

RAISE Ginseng. Roots Bring Fortunes. Circular. Fezler Seed Company. Patchogue. New York.

MAKE More Money!!! National Mail Order. Box 598. Minneapolis. Minnesota.

WOULD You pay 3%—first $350 made? Booklet "505 Odd, Successful Enterprises" free. Expect something odd! Pacific B. Oceanside. Calif.

ADDRESS. Mail circulars for advertisers. Complete instructions—list of firms—25c. Imperial. PS-3. Wilmington. N. Car.

"EVERYBODY Likes Candy." Learn to make professionally. (Our 40th year.) Ragsdale Candies. D10. East Orange. N. J.

NEED Money or Work—$50.00 daily. your own contracting business. Five simple tools required. No stock. Success first job. Wide field. Very popular. Anyone can apply. Money back guarantee. Working photos, layouts, instructions. $1.00 money order. Simonstone Associates. Lake George. New York.

HAVE Your Own Big-Money Business! Others are making up to $500 monthly in waterproofing and cement painting. Let me prove you may do as well! Few dollars starts you. Interesting facts free. Write today! Edgar W. Thomas. Barnesville 1. Ohio.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice. Argyle 2. Wisconsin.

HOME Book Shop Opportunity—Get orders by Mail. New! Different plan! Big profits. Everything furnished! National. Box 88-J. Dorchester. Mass.

## 58 FORMULAS, PLANS, ETC.

ANY formula $1. O. S. McCollum. 383 Miller. Vaux Hall. N. J.

10.000 FORMULAS and Trade Secrets. Free Literature. Stillmans. 555 Kingston Ave., Brooklyn 3. N. Y.

FORMULAS—All kinds. Latest products. Literature free. Kemico. Park Ridge 15. Illinois.

LABORATORY tested formulas. Lists free. Pont. Box 635-PS. Terre Haute. Ind.

## 59 PLASTICS

PLASTIC supplies, materials, instructions for hobby or business. Send for free catalog. Tells about internal carving. Hays Plastics. 2333 Lincoln Avenue. Alameda. California.

LUCITE. Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost. 1/16", 96c; ⅛", $1.25; 3/16", $1.52; ¼", $1.80. Colors add 10%. Include 10% postage. Almac Plastics. 230 Fifth Avenue. New York 1. N. Y.

INTERNAL carving. Lucite blocks, unpolished. 2"x3"x4", 70c; 1"x2"x3½", 25c; practice assortment 50c lb. Add postage. C & C Enterprises. 132 Rumsey Road. Yonkers. N. Y.

PLASTIC Sheets (Air Force Surplus) 19" x 23". Many uses. 3 for $1.00. Sterling. 511 N. Ashland. Chicago 22. Ill.

PLEXIGLAS—Write for Free Price List. The Unique Glass Shop. 309 Cowardin Ave., Richmond. Virginia.

PLASTIC. Sheets. Rods. Tubes. etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7. Mo.



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WHOLESALE Plastics supply catalog. 10c. Lucite, clear, colored, Metallic Acetate, 15 colors. Thick Lucite cutoffs, polished blanks for carving. Metal findings, tools. Ideas, bargains galore. Quantity prices on Casting Plastic. Gem-O'-Lite. Box 686Y. North Hollywood, Calif.

PLASTIC'S Low Prices, catalog, instruction booklet 25c. Plastic's, Box 1415, Salt Lake City 11, Utah.

MOLDER Plastic Letters and Numerals, for signs, displays, house numbers, etc. Free literature. Economy Precision Products, Germantown, Wis.

SPECIAL 3 prime Mashed 6" x 12" Plexiglas sheets $1.25 Postpaid. Carving Drills 1/16" 75c. 1/8" 85c each postpaid. Free Catalogue. Craft Plastics, Somerville, N. J.

## 60 CHEMICALS AND APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting. Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 15c. Established 1931. John H. Winn, 124-B West 23rd Street, New York 20, N. Y.

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

NEW Laboratory supply catalog of Chemicals and Apparatus. Contains many thousands of items with illustrations. Send 25c. Standard Science Supply Company, 1232 N. Paulina St., Chicago 22.

USEFUL laboratory item, catalog of chemicals, laboratory apparatus, kits. 10c. Rex Laboratories, 2849-B Birchwood, Chicago 45, Illinois.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology. 10c. Tracey Laboratories, Evanston, Illinois.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-26. Biological Supply Co., 1176 Mt. Hope Ave., Rochester 7, N. Y.

## 61 HELP WANTED

IMMEDIATE opening for reliable man with car to call on farmers. No experience necessary. $15 to $20 in a day. Permanent. McNess Company, Dept. 214, Freeport, Ill.

MAKE $20 a day! Complete line. Door name plates, knockers, numbers. Hubstamp, 359-B Congress, Boston, Mass.

"BIG PAY—TRAVEL South America-Pacific, Europe-Alaska, Construction, Oil, Mining firms hire Clerks, Engineers, Pilots, many Trades—pay bonuses. We can help you connect. Dollar brings advice where, how apply—Personnel Services, Box 785, Sacramento, California. $1.00."

EARN on your Kitchen table demonstrating sensational product. Good earnings. Send no money. Styleco, Dept. 92, Cincinnati 10, Ohio.

FOREIGN and Domestic Employment. Private firms or government. Office help. Construction workers. High pay, living quarters, transportation. South America, Alaska, Arabia, etc. Send $1 for Directory plus application forms, list of jobs, requirements, pay. No fees. Not an employment agency. Foreign Opportunities, Waseca, Minn.

INTERESTED in Latin American & Foreign Employment?????? $1.00 brings 1950 Copyrighted "Foreign Service Directory" World Wide Listings in Constructions; Oil, Mining; Aviation; Steamships; Manufacturers; Transportation; Exporters, Importers. Hot List Firms Hiring. How-When-Where to apply. Application form free. Global Reports, P. O. Box 883-S, Hollywood 28, Calif.

ALASKA—Last Great American Frontier. $1.00 brings 1950 Copyrighted Directory & Government Map Free. Big Construction Projects; Fishing; Mining; Aviation; Hunting-Fishing-Game rules; Fur-Farming; Lumber; Live Stock; Agriculture. Homestead Land & Highway information. Listing firms hiring. Application form. Alaska Opportunist, P. O. Box 883-S, Hollywood 28, Calif.

JOBS! Coast-to-Coast vacancies. Many trades, professions. Housing information. Free particulars. Business Services, Baldwinsville, N. Y.

FOREIGN Employment. Construction men, building trades, mechanics, helpers, office men. Good workers interested in Foreign Development Projects. Pipe lines, Dams, Power Plants, Roadways, Shipping, Oil refineries, etc. Transportation and quarters furnished; High wages. Listings of firms actively working on projects in Arabia, Persian Gulf, Africa, Alaska, Canada, South America, Europe, etc. Send $1.00 for Foreign Construction Compendium and Application forms. Foreign Service Bureau, Dept. PS4 (Employment) P. O. Box 295, Metuchen, N. J.

## 62 AGENTS WANTED

PHOTO-Salesmen-Agents. Sell beautiful hand-colored plastic enlargements. Collect deposit, we deliver. Profitable sideline. Send card for free sample kit. Novel Portrait Co., 3343-A North Ave., Chicago, Ill.

SEWING Machine electrification kit. Nationally advertised. Has Good Housekeeping Guaranty Seal. Can be demonstrated and sold in 5 minutes. Make at least $5 per sale. For complete details write today to Brownell Distributors, Inc., Dept. PS, 308 Canal St., New York 13, N. Y.

NYLON, Poplin, Rayon Uniforms, white and colors. Immediate Delivery. Immediate Profits. Sell to Doctors, Dentists, Nurses, Waitresses, Beauticians, Housewives. Free Sales Kit. Superior Fabrics, Dept. A-1, 3936 Market St., Phila. 4, Pa.

WHERE To Buy 800,000 articles direct from Manufacturers. Save by buying direct. Sent Free. "Your Profits Under the Spotlight." Glass Pub. Co., Ellwood City 3, Pennsylvania.

FREE Samples. Big profits showing amazing Glow-In-The-Dark Specialties. House numbers, pictures, plastic novelties, ashtrays, keyholders, religious and nursery objects, etc. Madison Plastics, 303 Fourth Ave., New York 10, N. Y.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of Automobile Initials and Sign Letters. Free Samples. "Ralco", XL-Roxbury, Boston 19, Mass.

START Your Own Business on Credit. Always your own boss. 1554 Dealers sold $5,000 to $26,500 in 1948; their average $6,742. We supply stocks, equipment on credit. 200 home necessities. Sales experience not needed to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh Co., Dept. 192-PSC, Freeport, Ill.

BE first! Sell this sensational new assortment. Contains everything but the food . . . The invitations, table cover, napkins, nut baskets, place cards, snapper hats, cups, plates, game booklet and six different games: a complete party for eight. Sample $1.25. Also America's leading greeting card line featuring personalized stationery, napkins, book matches and exclusive new Wedding invitations. Free Samples. Elmcraft Chicago, 5930 S. Western, Chicago 36, Illinois.

DOUBLE Your Income—Sell wool and Cotton uniforms, Badges, Initial Buckles, Belts, etc. Write Hook-Fast, Box 480PS, Roanoke, Virginia.

NEWEST money-making sensation, miniature authentic replicas, police and firemen's badges also pocket pieces, key chains. Write for descriptive folder. Hook-Fast Specialties, Dept. 23, Box 1425, Providence, R. I.

$85.00 WEEKLY selling 4 pair shoes daily direct. Free Outfit, Samples. No investment. Experience unnecessary. Advance commissions, bonus. Paragon Shoes, 738 Columbus, Boston, Mass.

FAST profits—No investment. Send for big, free catalog. Plastic aprons, tablecloths, etc. 150 sure-fire items. We guarantee sales. Write The Halliday Company, Dept. P-3, 347 Broadway, Passaic, N. J.

PROFIT Making Novelties—Two for samples $1.50—Folder free. Roger Enterprises, Waverly Place, Tuckahoe, N. Y.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark, Chicago.

JEWELRY For Salesmen Distributors Direct Factory. Catalog Free. Pickcraft (c 19) Bank St., Attleboro, Mass.

AGENTS. Sell finest food products direct to homes. Successfully sold for 25 years. Big profits. Powerful combination sale plans make sales easy. Permanent repeat business. Powerful premiums and free door openers for easier sales. Samples furnished. Live territories open to distributors. Mother Hubbard Products Co., 4139 Grand, Dept. S-Z, Chicago.

AT last! Something New and Sensational in Everyday Cards. Make Extra Money Fast! Show Gorgeous Satin Velour Metallic Cards. Get orders easy. Scented Stationery, Charmettes, Napkins, Kiddie Cards, 25 other Assts. Retail 60c to $1.25. Samples on Approval. Puro Co., 2801 Locust, Dept. 041-D, St. Louis 3, Mo.

SCHOOL Seniors!!! Your postal will bring our wonder, Kwick-Sell Cardalog of popular Graduation Name Cards. Biggest profits!!! Only firm giving free souvenir chest and Card Case. Don't miss out! Hurry that postal!!! Craftcards, Box 235 (M), Pittsburgh 30, Pennsylvania.

BE Renewal Headquarters for all magazines. Big profit in Christmas gift sales now. No experience—No capital needed. Free Catalog tells how. Write: McGregor Magazine Agency, Dept. 519A, Mount Morris, Illinois.

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New Foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

EXTRA Money! Sell new, different greeting cards. Complete line includes Regal Plastic assortment, metallics, "stand-up" and "double" cards. Free samples Exclusive Imprinted and Engraved Stationery. Sales Kit on approval. Regal Greetings, Dept. PS-14, Hazel Park, Mich.

AMAZING offer—$40 is yours for selling only 50 boxes. Also entirely different, new Deluxe All-Occasion assortment with television card. Little Pearls, Hankie Gift Greetings, other surprise items. Feature boxes on approval. Free samples imprinted stationery and Rose Scented Notes. Write today. It costs nothing to try. Cheerful Card Co., 1298 White Plains, N. Y.

NYLONS given free if Sheerkraft hosiery doesn't live up to amazing three month written guarantee enclosed with every order! Over 570 styles, sizes, colors! Big commissions. Big bonuses. Sheerkraft, Box 72-G, Newark, N. J.

WHOLESALE/retail Indian Carpets; Arts and Crafts; Silk, Sarees; Tea, Coffee; Coconuts; Cashewnuts; Dry Fruits; Indian Musical Instruments; Postage Stamps available. Address—P. O. Box 1477, Bombay, India.

CALENDARS and Advertising Novelties full time or side line. Every business Wants Them. Few calendar Salesmen are on the road now which means more sales for you. Fleming Calendar Co., 6539 Cottage Grove, Chicago 37, Ill.

IF You Sell, you need Opportunity Magazine—the "Salesman's Bible," packed with down-to-earth ideas that boost your earnings; filled with hundreds of announcements of new, fast selling items and lines. Send your name and tell us what you're selling now for Free copy of latest issue. No obligation. Opportunity, 28 E. Jackson, Dept. 31, Chicago 4, Ill.

LOOK! Sell initialed individualized belts, buckles, cap badges, tie holders, etc., choice 2000 emblems. Write special outfit offer. Hook-Fast, Box 1425PS, Providence, Rhode Island.

INFORMATION—Wholesale supply sources. Moneymaking plans. Increase your income. Write Reynard Station, Smithfield 3, Ohio.

GREETING Card bargains. Personalized Napkins, Book Matches. 4154-B Fifth Street Philadelphia 40.

EXCELLENT sideline for agents calling on jewelers. No selling. Easy repeat earnings. Inquire Modern Technical Supply, 55-PS West 42nd Street, New York 18.

SELL Ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious, "7 x 11" cost 6c, sells 35c. Make money. 15 samples $1.00 postpaid. Lowy, 8 West Broadway, Dept. 512, New York 7.

SENSATIONAL nylons guaranteed against runs. Nationally advertised. Not sold in stores. No experience or money needed. Also lingerie, robes, men's hosiery. Outfit, sample, etc. free. Wonderful opportunity earn big money spare or full time. See our full page advertisement on page 71. Kendex Co., Babylon 749, N. Y.



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NEW Leopard Blanket, profitable deal. Tyrcha Wholesale Co., 4532 N. Meade Avenue, Chicago 30, Ill.

$1 STARTS you in business. Sell top quality $1.00 ties. Now only $7.20 dozen, your profit $4.80 dozen. Regular $1.50 up values. Send $1.00 for Introductory Offer two ties. Catalog complete line free. Philip's Neckwear, 20 West 22nd St., Dept. P-41, New York 10.

SELL Big Money-Maker to men and Women. Easy handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Mass.

SELL $2 Fire Extinguishers. Locally mailorder. Lorrac Products, Albany 1, N. Y.

WOULD you pay 3%—first $350? Booklet "505 Odd, Successful Enterprises" free! Work Home. Expect something odd! Pacific B, Oceanside, Calif.

HOT Special! Power Mowers—$59.50. Delivered. World's cheapest. Modern. 7401-BC North Kansas City, Mo.

SELL!! Balloons, Combs, Specialty Merchandise. Carleton House Distributors, Texas City, Texas.

HOUSE Paint—Your name on label. Agents wanted. Experience unnecessary. Free sample. Certified Products, Louisville, Ky.

AGENTS and distributors wanted. Big profits. Amhar Industries, Plant 3-D, Huntington, New York.

BUY thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save." Service Publishing, 218-B Investment Bldg., Pittsburgh 22, Pa.

FREE—Successful "Beginners" Mail Order Plan. Lynn, 5710-C Bankfield, Culver City, California.

CLINTON powered mowers. 40% Mark-Up. Delivered. World's cheapest. Rotacut. R-2031, Excelsior Springs, Missouri.

PROFITS Unlimited with lowest-priced reflecting numbers and letters. Bright by day; brilliant at night. Up to 100% profit. Prospects galore—homes, stores, farms. Write for Free details. Nite-Brite, 216 N. Wabash Ave., Dept. 40, Chicago 1, Ill.

"BASEBALL" By Connie Mack. New red hot seller! Thrilling inside story of America's National Game By "Mr. Baseball" himself—"My 66 Years In The Big Leagues." Large book; 300 pages. Beautifully illustrated. Sells on sight! Big cash daily. Write for starting outfit! Universal House, 1010-BB Arch, Philadelphia, Pa.

COMMERCIAL Deep Frying Course. Mock Chicken Legs, Potatoes. New and proven methods. Learn about this money-making field. $2.50. PP. Concession, Toledo 13, Ohio.

WHOLESALE Men's Hygienic Supplies! 48 Samples, $3.00! List Free. Acme, Covington 3, Virginia.

MEXICAN feather pictures. Big profits! No investment: Free details. Sample 10c stamps. Sylvia-Sa, Apartado 9036, Mexico City.

FREE Literature—Thousands Wholesale supply sources. Moneymaking Business ideas. Wilkin, Hillsboro 2, Ohio.

DRESSES 16c; Coats $1.00; Blouses 35c. Free Catalog. Crown, 164PB Monroe St., New York.

## 63 HIGHGRADE SALESMEN

BIG Money Taking Orders: Shirts, Ties, Sox, Pants, Jackets, Sweaters, Shoes, Uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AV Lincoln, Chicago.

START your own business on Credit. Always your own boss. 1554 Dealers sold $5,000 to $26,500 in 1948; their average $6,742. We supply stocks, equipment on credit. 200 home necessities. Sales experience not needed to start. Wonderful Opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh Co., Dept. C-U-PSC, Freeport, Ill.

BIG Cash Profits for men and women introducing Flexiclogs, sensational new flexible footwear. Experience unnecessary. Nationally advertised styles for women, children, men. Excellent sideline, no investment. Easy to average hundreds of dollars weekly. Free sales helps and sample offer. Get details now! Flexiclogs, Dept. B14246, New Holstein, Wisconsin.

EARN Big Money Fast! Sell finest quality advertising work uniforms to garages, factories, filling stations, etc. Free selling kit Topps, Dept. B-20, Rochester, Ind.

SALESMAN-Sideline. Earn $3,000 next 5 months selling calendars, advertising specialties. Buyers everywhere. Big comm. Advanced. Samples free. Continental Calendar, 542-B South Dearborn, Chicago.

SENSATIONAL Nylons guaranteed against runs. Nationally advertised. Not sold in stores. No experience or money needed. Also lingerie, robes, men's hosiery. Outfit, samples, etc. Free. Wonderful opportunity earn big money spare or full time. See our full page advertisement on page 71. Kendex Co., Babylon 749, N. Y.

SALESMEN—absolutely make $50.00 a day. New sensational utility item for every food, beverage outlet, etc. Samples furnished. Johnson-Hill, 53-U West Jackson, Chicago 4.

SALESMEN—Put yourself in line for big money, real future. Keep stores supplied with 5c-10c to $1 counter goods. Nationally advertised. Top profits for you and merchants. Liberal deals boost sales. Sideline or full time. World's Products, Dept. 83-D, Spencer, Ind.

## 67 EDUCATIONAL AND INSTRUCTION

BE A real estate broker through home study or classroom instruction. Write for free book. Approved for veterans. Weaver School of Real Estate, 15 E. Pershing Rd., Box PC-11, Kansas City 8, Mo.

WANT a steady Big Pay Job in Diesel? Our approved, easy-to-understand Diesel Training Course qualifies you. Placement advisory service Free. Learn as you earn. Write for free 24 page book today! Interstate Training Service, Dept. 2N, Portland 13, Oregon.

BOOKKEEPERS! Increase your earnings! Operate your own simplified "Dollar-A-Week" Bookkeeping and Tax Service. Full or spare time. Details Free. No obligation. Ellis, Box 203, Cedar Grove, North Carolina.

PIANO Tuning Pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—51st year. G. I. Approved. Write for booklet. Niles Bryant School, 77 Bryant Bldg., Washington 16, D. C.

EXPORT! Learn at home from established World Trader. Big paying positions. Your own profitable world-wide business by mail order without capital; or travel abroad. Experience unnecessary. Free booklet. Mellinger, 203-W, Los Angeles 24, California

HOME Study Course, Chiro-Deo-Therapy, Drugless Healing Certificates, Diplomas, Degrees. Jacumba Hot Springs, Jacumba, California.

LEARN the Collection Agency business. Highly profitable. Easily mastered. Free folder. Cole Associates, Syracuse 2, N. Y.

LEARN Piano Tuning, Repairing—at home in 30 days. Unlimited income. Phonograph recordings, tools and instructions furnished. Write Capitol City Tuning Co., Department C-233, 129 East Michigan, Lansing 16, Michigan.

MAKE Up To $35-$45 Week as a Trained Practical Nurse! Learn quickly at home. Booklet free. Chicago School of Nursing, Dept. M-3, Chicago.

BECOME a Doctor of Psychology or Metaphysics. Teach secret of contentment, happiness. Win degree of PsD. or MsD. Solve mental worries. Free book. College of Universal Truth, 5153-K N. Clark, Chicago.

PRINTING Trade Home Course. Chapter $2.00. Printing A. Institute, 4328 Lincoln, Chicago 18, Ill.

U. S. Civil Service Jobs. Start high as $66.35 week. Secure positions. Men-Women. Qualify Now for many expected openings. Experience usually unnecessary. Free 40-page book shows jobs, salaries, sample tests. Write: Franklin Institute, Dept. D-34, Rochester, N. Y.

U. S. Civil Service jobs. Start high as $66.35 week. Secure positions. Men-women. Qualify now for many expected openings. Experience usually unnecessary. Free 40-page book show jobs, salaries, sample tests. Write: Franklin Institute, Dept. D-22, Rochester, N. Y.

SELFSTUDY Courses: High School, College, Triplespeed NUABC Shorthand. Request Bulletins. Capital City College, Washington 5, D. C.

FASTER Mind! Try "Thinking-Alphabet." Write Frank Tibolt, 17A, Phila. 20.

USED Correspondence Courses. Bought, Sold, Rented. Free Literature. Baker, 5509-A Winthrop, Chicago 40.

LEARN Gunsmithing! Details, copy "Guns and Gunsmithing" 25c. Gunsmith, Palatine 3, Illinois.

MEDICAL Laboratory Technicians in great demand. We train you in your own home. Catalogue free. Imperial Technical Institute, Box 973-B, Austin, Texas.

FREE Booklet "How to make working contact with the bigger man within you," with full details about our home-study "behavior-control" plan. Let us send yours without obligation. School of Personal Psychology, Tenth Floor, Washington Bldg., Louisville 2, Ky.

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AMATEURS—Radio and Electrical Research Engineering. H. Y. Twillmann. R. R. #1. Chesterfield. Mo.

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Man or woman—young or old, YOU can earn a steady income in full or spare time as an independent Kendex dealer. Amazing and almost "impossible" earnings can become a reality for you. Herbert Armstrong of Tenn. earned $202 in 9 days. C. O. Watkins of Oregon sent 92 orders in one day. You have the same opportunity to duplicate these exceptional earnings. Over one million dollars will be earned in 1950 by Kendex dealers—why not let us establish you in your own business and get a share of these wonderful earnings?

### KENDEX NYLONS REPLACED FREE . . .

if they run or snag within guarantee period up to three months! Impossible? It's true! No matter what the cause—hard use or deliberate abuse—whether it is fault of the hose or the wearer—Kendex nylons are replaced FREE if they run, snag or become unfit for wear within the guarantee period. How could any woman resist a positive guarantee of satisfaction when she can obtain it without paying any more than other standard advertised brands? Kendex nylons are NOT sold in stores, so you have no competition. Complete line includes everything from heavy 70 denier service weight to gossamer luxurious ultra sheer 15 denier 60 gauge. Proportioned sizes and lengths. Latest colors plus white.

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In addition to the sensational Kendex nylons, you will have a complete line of glamorous lingerie, beautiful robes and housecoats plus a complete line of Kentcraft mens' hosiery guaranteed for one full year. Any pair or pairs of men's hose that does not give satisfactory wear within one year of purchase will be replaced FREE!

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**KENDEX COMPANY, BABYLON 849, N.Y.**

KENDEX COMPANY
BABYLON 849 N.Y.

Date.....1950

Send me, free and prepaid, everything I need to make money as a Kendex dealer, including sample stocking etc. There is nothing for me to pay now or later and I am under no obligation in accepting your money-making outfits.

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**WALTCO PROCESS PERFECTS SOLID FIBRE-GLASS RODS AT LOWEST PRICE YET!**

**Cross section** shows magnified view of thousands of glass fibres before exclusive Waltco process fuses them into **solid**, flexible translucent shaft to form one of **toughest** materials known.

FROM **$9.95**

In 5 lengths: 3½'—$9.95; 4'—$10.95; 4½'—$11.95; 5'—$12.95; 5½'—$13.95; includes case with dowel.

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- Power, strength with permanent live-action.
- Exclusive Waltco Pistol Grip.
- Finest stainless steel guides and tip, nylon windings, triple lacquered.

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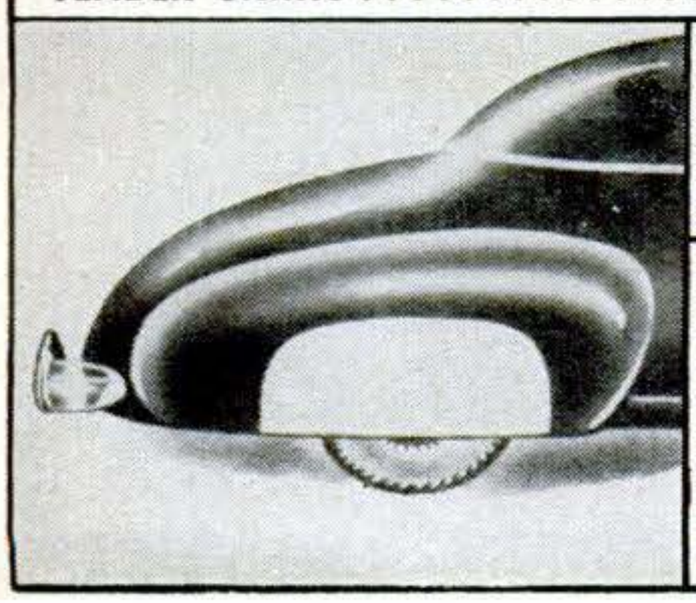

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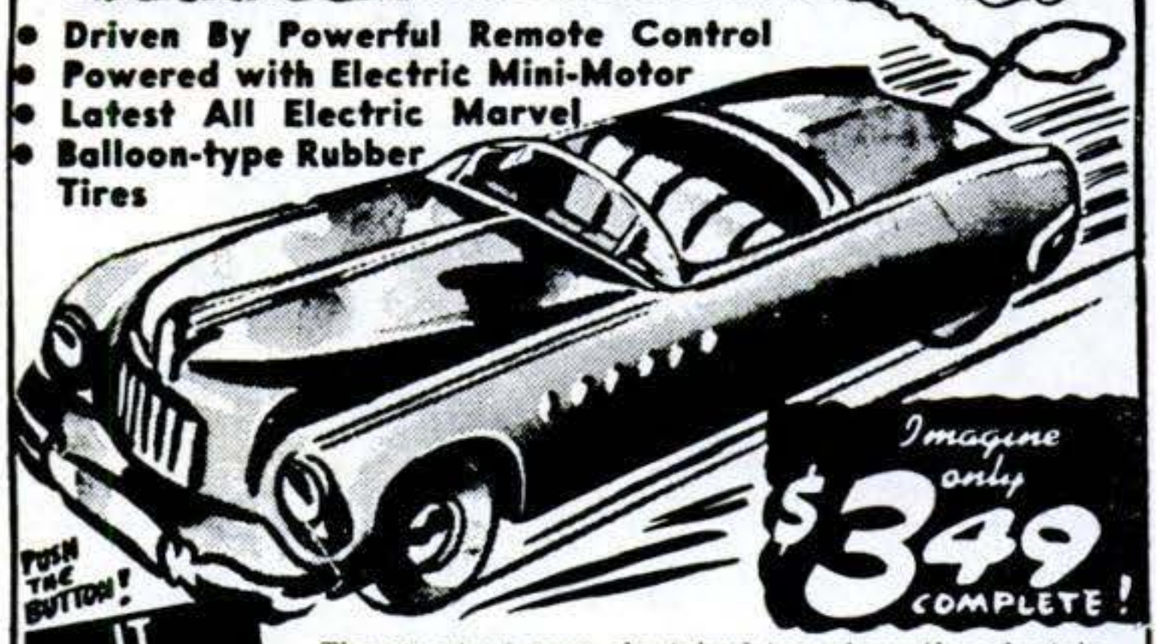

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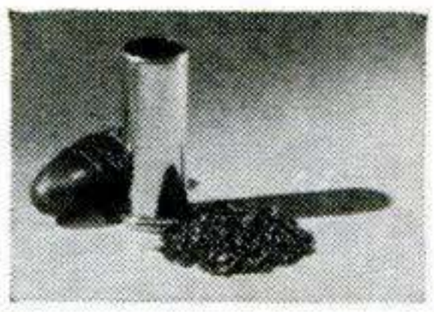
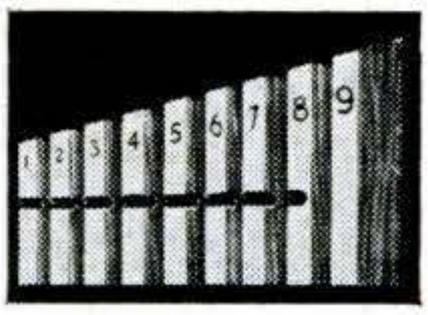
# Smashing Power

## in REMINGTON "HI-SPEED" 22's



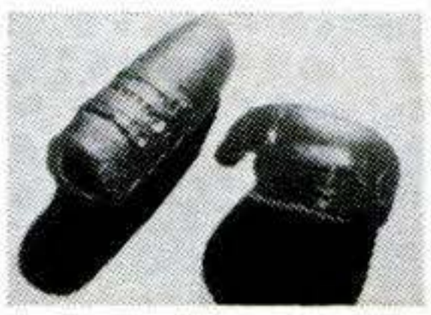
**Progressive - burning smokeless powder** is lightning fast and powerful. Strong nickel-plated case.

**Smashing energy.** Solid-point bullet delivers sledgehammer blow equal to 158 ft. lbs. at the muzzle. That's real punch.




**Penetration power** of the Remington Hi-Speed long rifle solid-point bullet drills through seven ⅞-inch pine boards at 10-yd. range.

**Shock Power.** Look what happens to a cake of laundry soap when it's blasted by a Remington Hi-Speed 22 hollow-point bullet!



**Hollow-point bullet** of Remington Hi-Speed 22 expands to almost twice its original caliber on impact. Real stopping power!

Next time you buy 22 ammunition for hunting, plinking or pest shooting, ask for Remington Hi-Speed 22's. They'll deliver maximum accuracy, blinding speed and walloping, smashing power every shot. And they have exclusive non-corrosive Remington "Kleanbore" priming that keeps your rifle accurate. Get more out of shooting . . . get Remington Hi-Speed 22's!

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"Hi-Speed" and "Kleanbore" are Reg. U.S. Pat. Off. By Remington Arms Company, Inc., Bridgeport, Conn.



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**GENUINE WEEDLESS BAIT**
**AT YOUR DEALER**
**$1.10**
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**Choice 6 colors**
**With Spinner for extra flash and action—$1.21 ea.**

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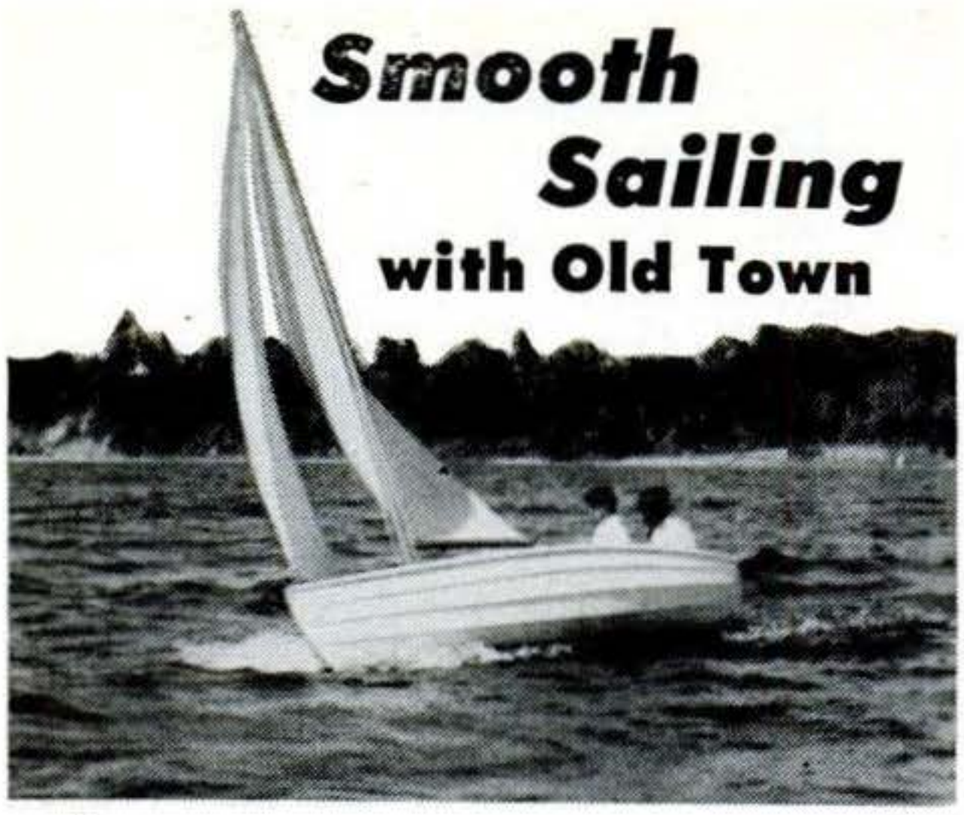


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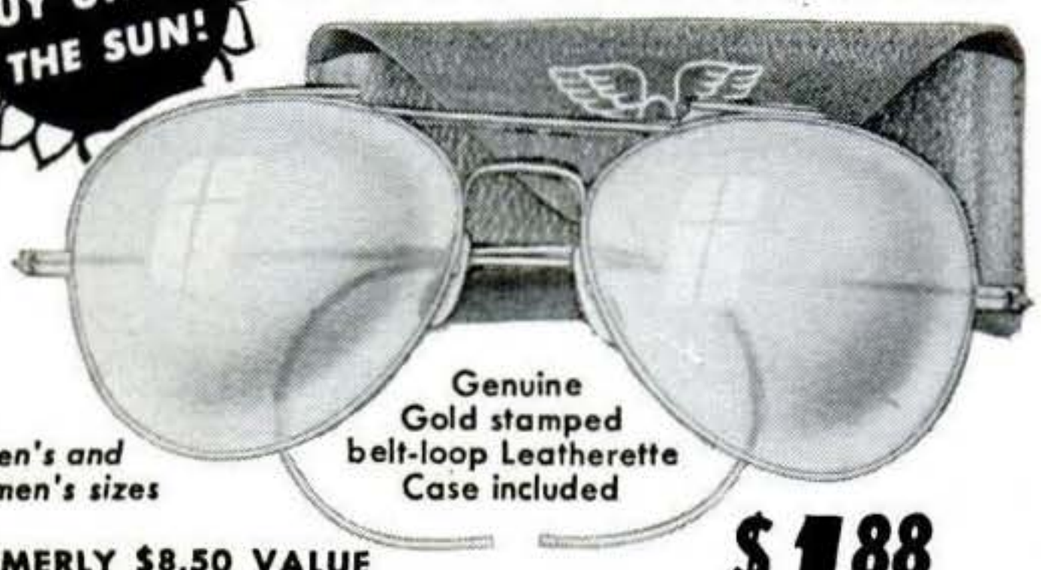
BEST BUY UNDER THE SUN!



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*Men's and Women's sizes*

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**Makes Your Stop Light Flash 115 Times a Min.**

**FREE OFFER TO YOU!** The "Stop-It" warns cars behind—makes your stop light flash on & off, on & off! Completely automatic, acts instantly when you step on foot brake . . . attaches in 5 minutes to any car or truck. Approved by safety engineers, used by Police & Fire depts. Non-rusting, dust, oil, vapor, waterproof. Write NOW for free introductory offer—no obligation. Get this amazing "Stop-It" for your car at no cost to you! Dealers, salesmen wanted.

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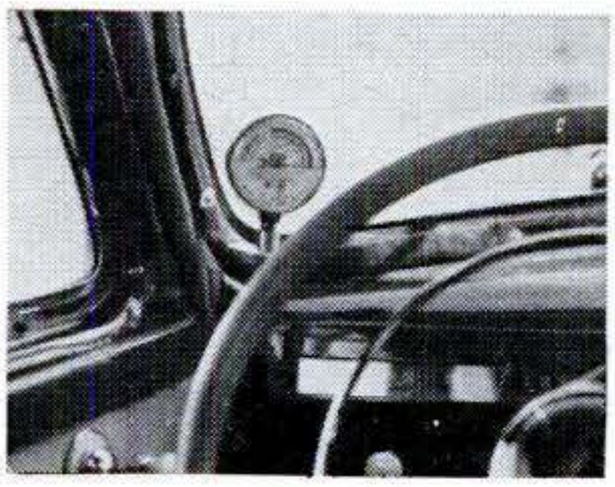

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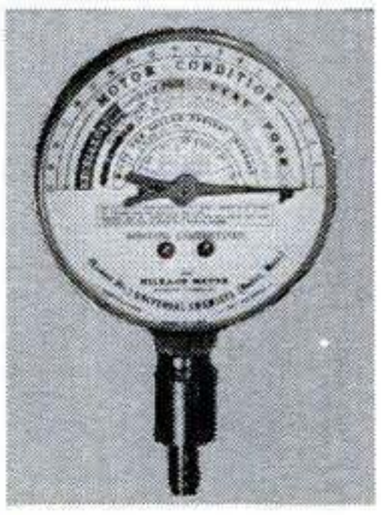

Fits all cars—permanent. Checks spark plugs—checks carburetor and 31 other motor adjustments. Registers miles per gallon at every speed.

Simple to read—Dial in 4 colors. No holes to drill—anyone can install in 1 minute.

Complete instructions furnished.

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2¾" in diameter.

ONLY $7.50 P.P.D.

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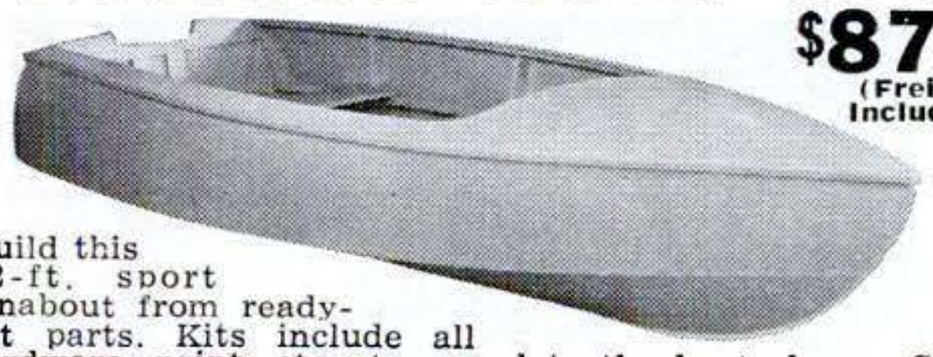
# PLYWOOD BOAT KITS

**$87.50** (Freight Included)



Build this 12-ft. sport runabout from ready-cut parts. Kits include all hardware, paint, etc., to complete the boat shown. Send for free folders of all models as low as $29.95 *freight included.*

**TAFT MARINE WOODCRAFT**

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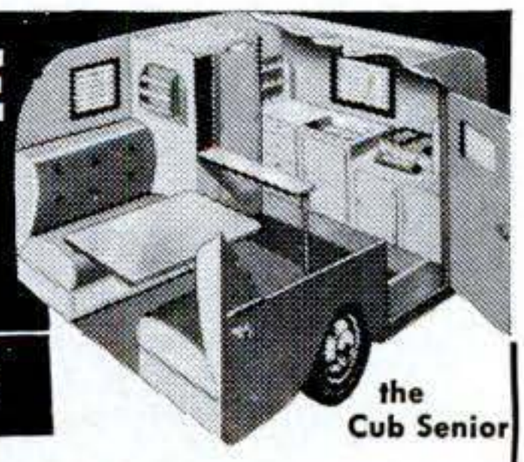
**SAVE UP TO 50%**



the Cub Senior

We ship complete trailer kit . . . everything fits perfectly. Factory finished panels & sub-assemblies easily assembled in a few hours with only a hammer, wrench, and screwdriver.

**"CUB" SENIOR** (above) A walk-in trailer with everything shown 10' long, 6'4" wide and 6'9" high . . . **ONLY** $395. F.O.B., Los Angeles. **"CUB" SPORTSMAN** (Teardrop camper model) Aluminum body, steel frame. 12'7" long, 6' wide, 5' high **ONLY $279.50** F.O.B., Los Angeles. DEALER INQUIRIES INVITED.

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# Outboard News

*About the new Scott-Atwater SHIFT motors*

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**PLENTY!** He shouldn't be struggling with that oar. With a new Scott-Atwater *Shift* outboard, he could make safe landings under power! You just ease up in Forward, *Shift* to Reverse to brake speed, then *Shift* to Neutral.

**Get a COMPLETE Shift**—with Neutral, Forward, Full Control Reverse. You back up by *Shift*ing to Reverse, not by swinging the whole motor around. All controls are always facing you. You have complete maneuverability—full control of steering, speed, and *Shift*. That's the *complete Shift*—the kind you'll find on all 4 Scott-Atwater *Shift* models.

## Biggest Improvement

● *"Sure think the Shift is the biggest improvement since the outboard was invented. I own a 1-16."—Louis Vandervest, Green Bay, Wis.*

## FOUR SHIFT MODELS!

**NO OTHER OUTBOARD LIKE THE 1-30!** 1 to 30 m.p.h. Separate "stow-away" gas tank—automobile-type fuel pump. Steering-handle control of throttle *and* spark. And all four *Shift* models have the *complete Shift*, plus single knob control, push-button carburetor drain.

**1-14 SHIFT 4 hp* twin**
1 to 14 m.p.h. **$149.50†**

**1-16 SHIFT 5 hp* twin**
1 to 16 m.p.h. **$179.50†**

**1-20 SHIFT 7½ hp* twin**
1 to 20 m.p.h. **$199.50**

**1-12 Non-Shift 3.6 hp** single**
1 to 12 m.p.h. **$99.50**

†West Coast price slightly higher

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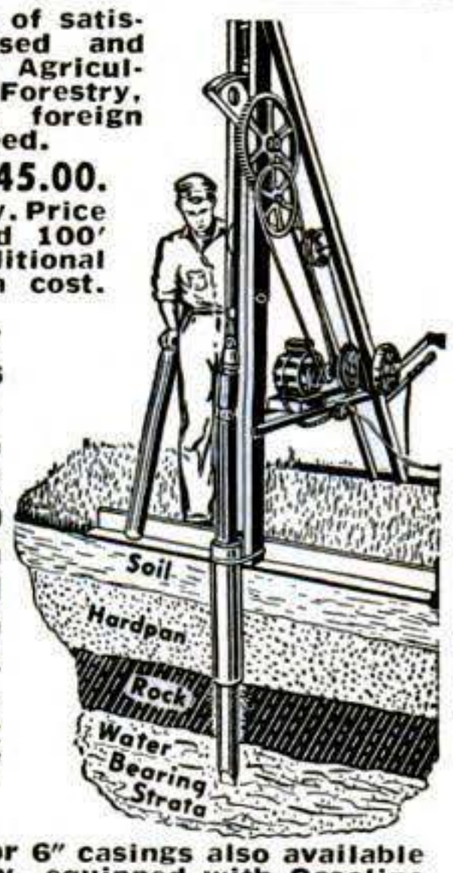


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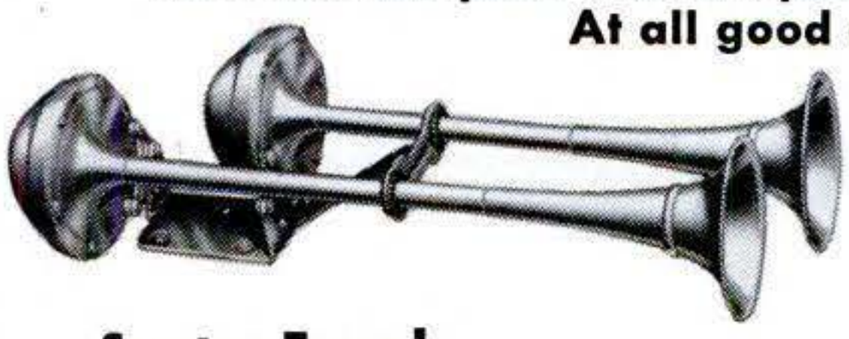

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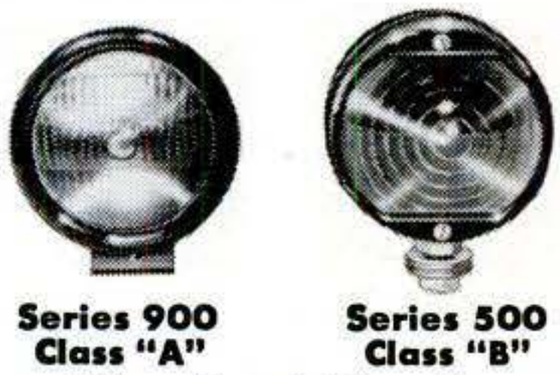

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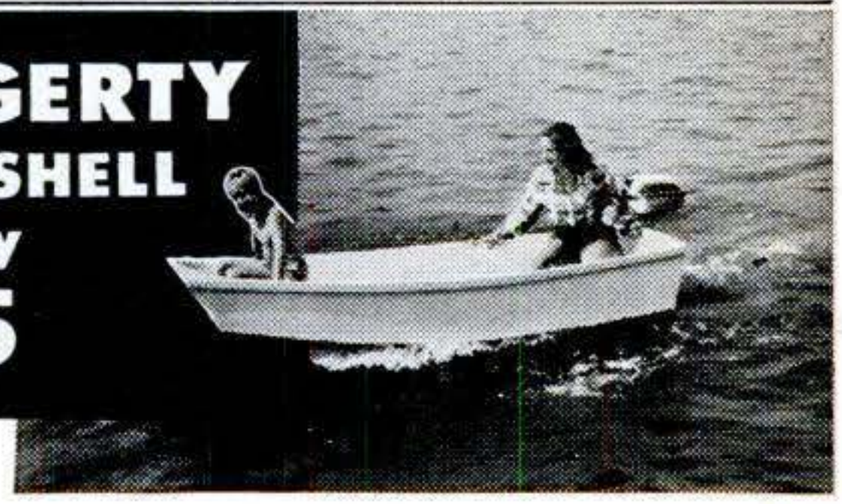

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• Assemble this handy 8-footer yourself and save half the price of a ready-made boat! Light (65 lbs.) for easy carrying, rowing, towing. Yet the HAGERTY SEA SHELL is ruggedly built to give you years of fun. Carry on your car top to beach or lake. Holds three adults in safety. Takes a small outboard. Ideal for all-around use. Over 15,000 in service.

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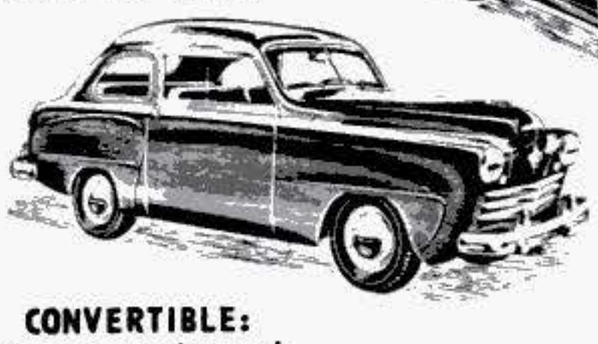

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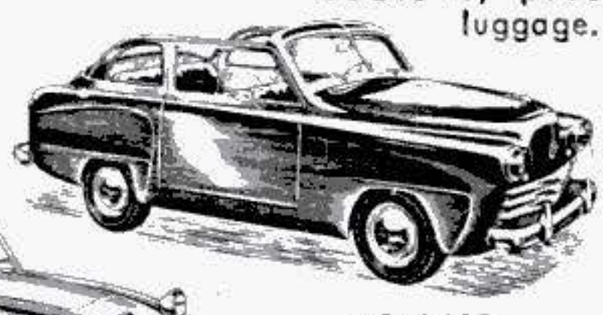
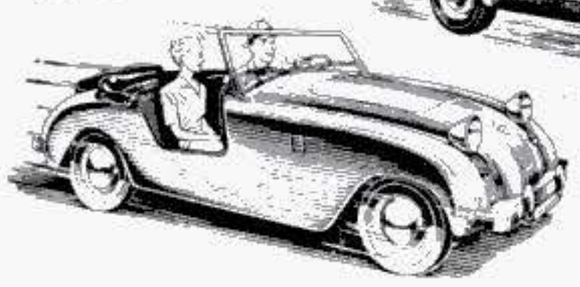
**CONVERTIBLE:** Price reduced $101. Four passenger. Easy-to-handle top. Big luggage space.





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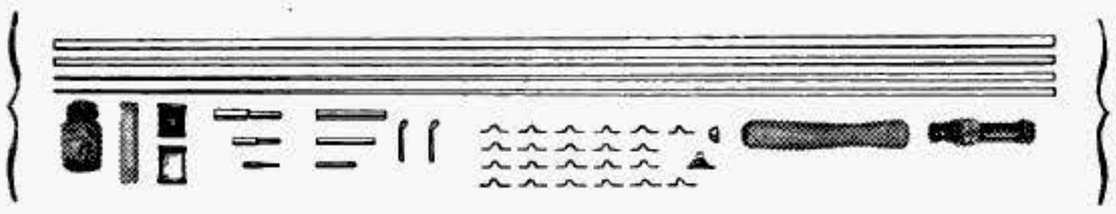

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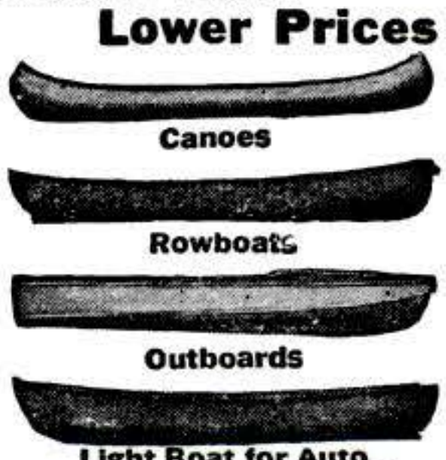


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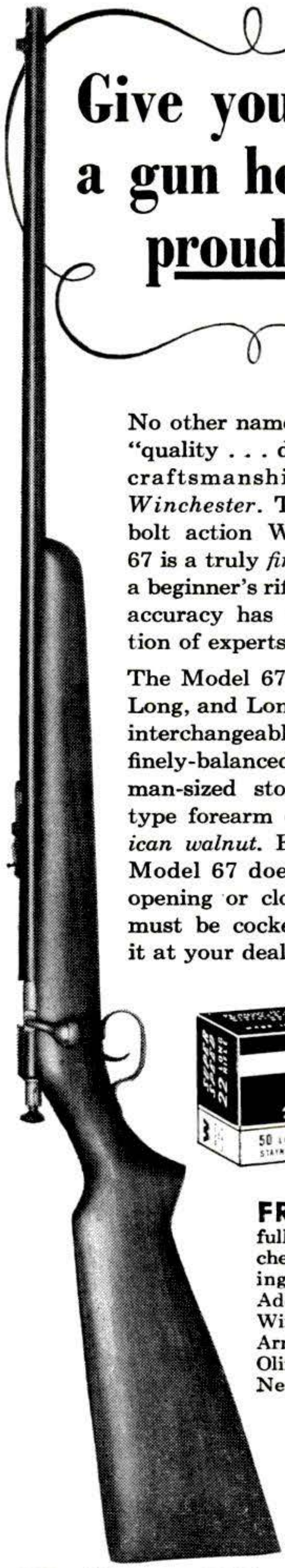

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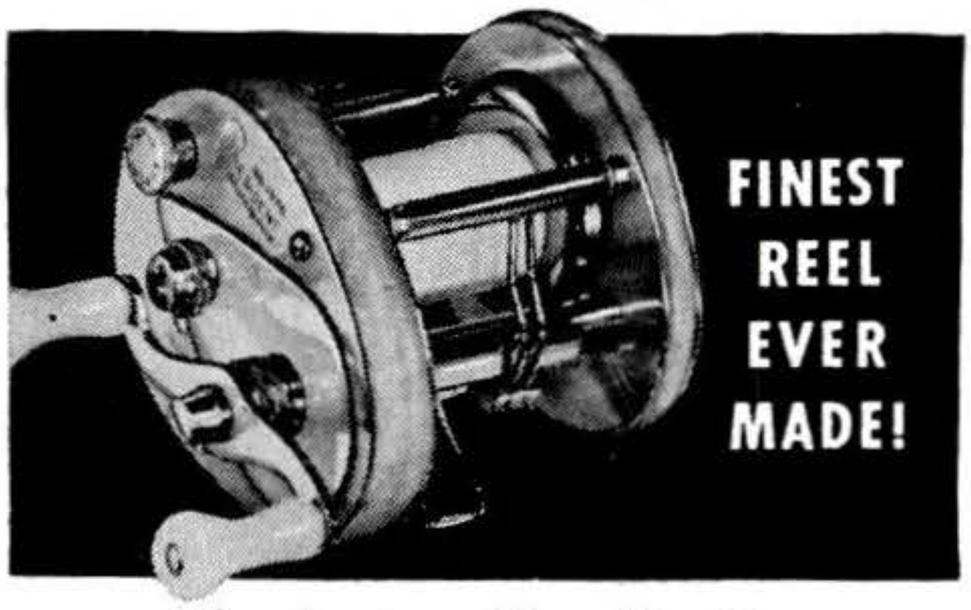


### *The Longer You Use It, The Smoother It Seems to Run*

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**HONOR BUILT SINCE 1897**

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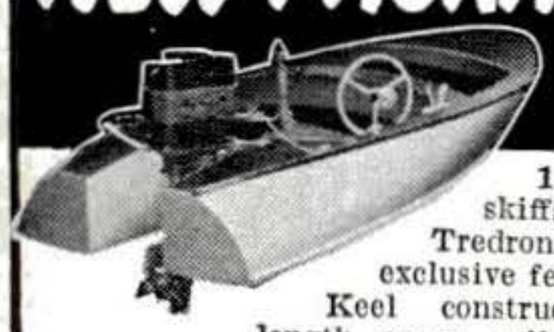

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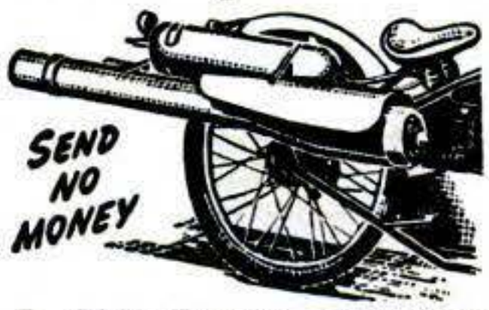


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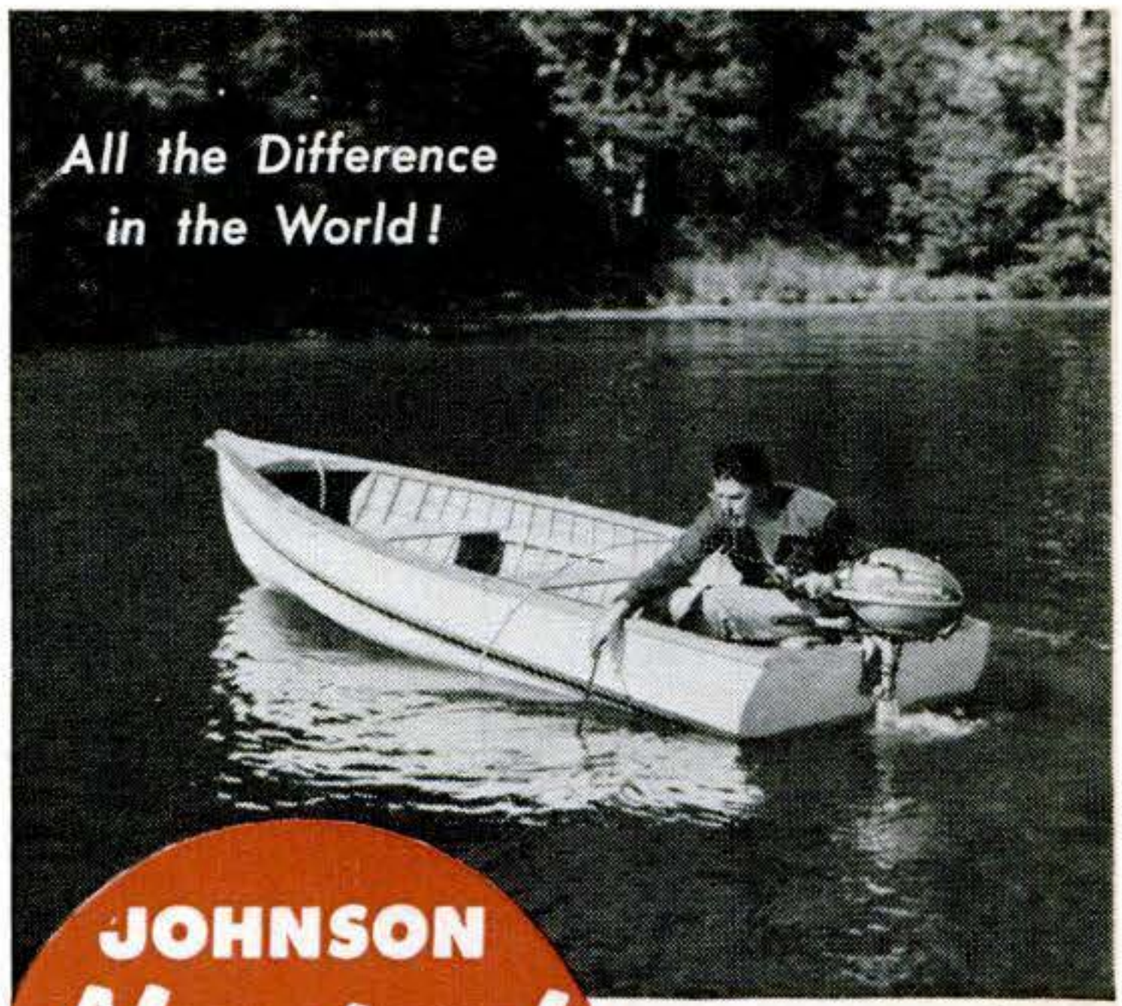


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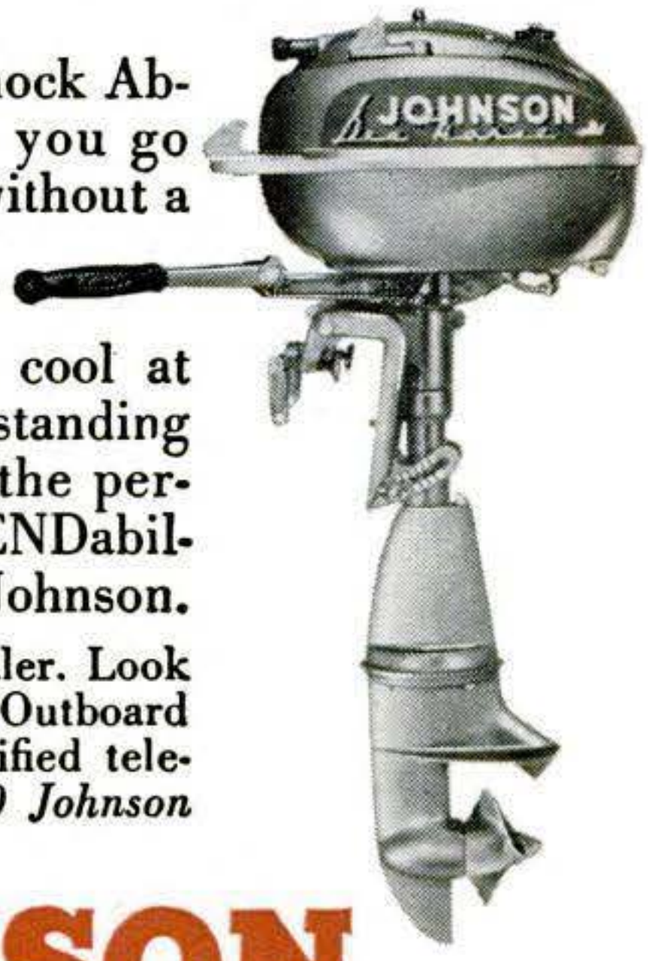


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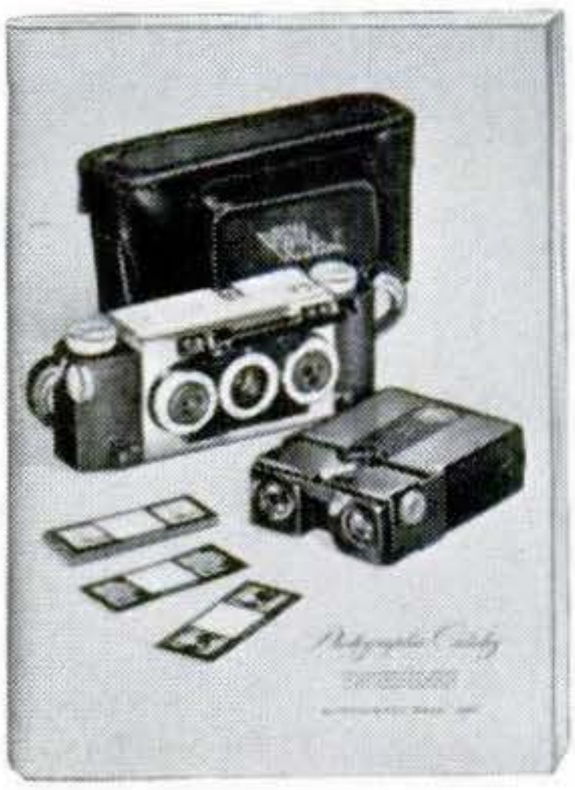

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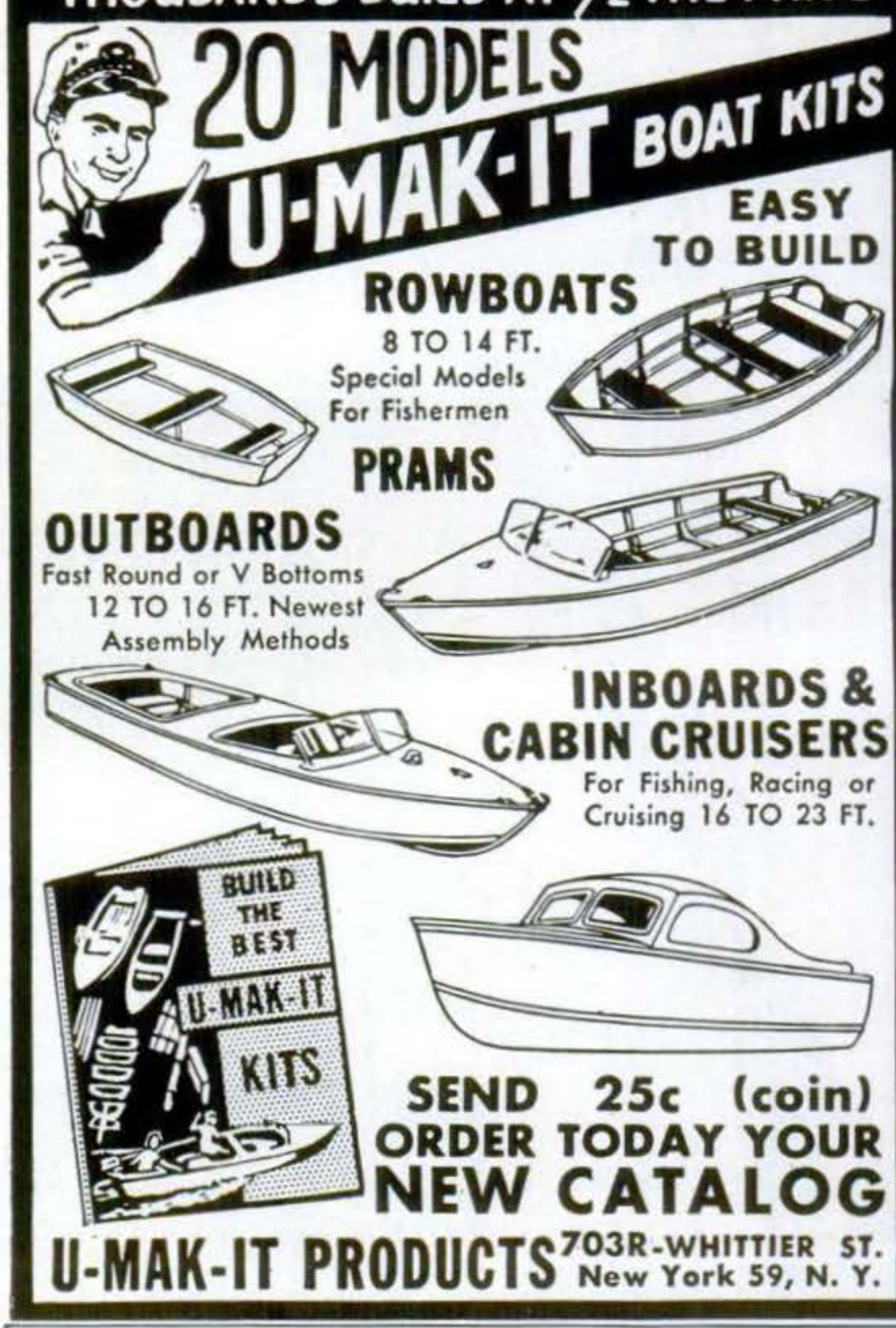

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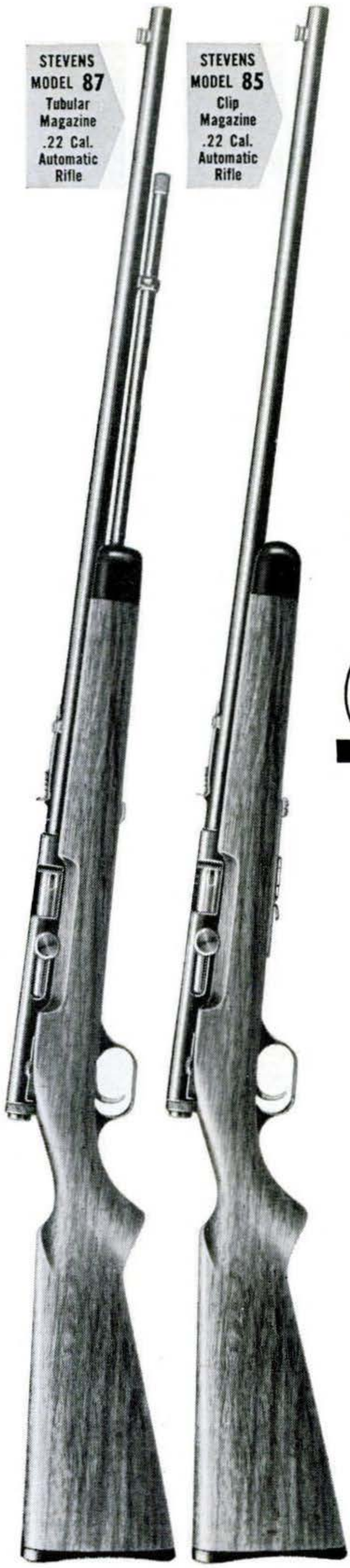


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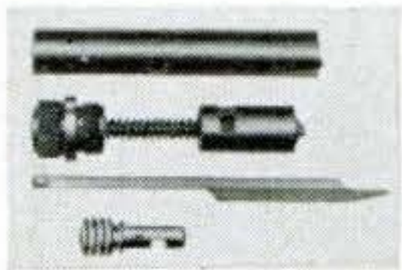

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New Duo-Cone loudspeaker, developed at RCA Laboratories, achieves the illusion of "living presence."

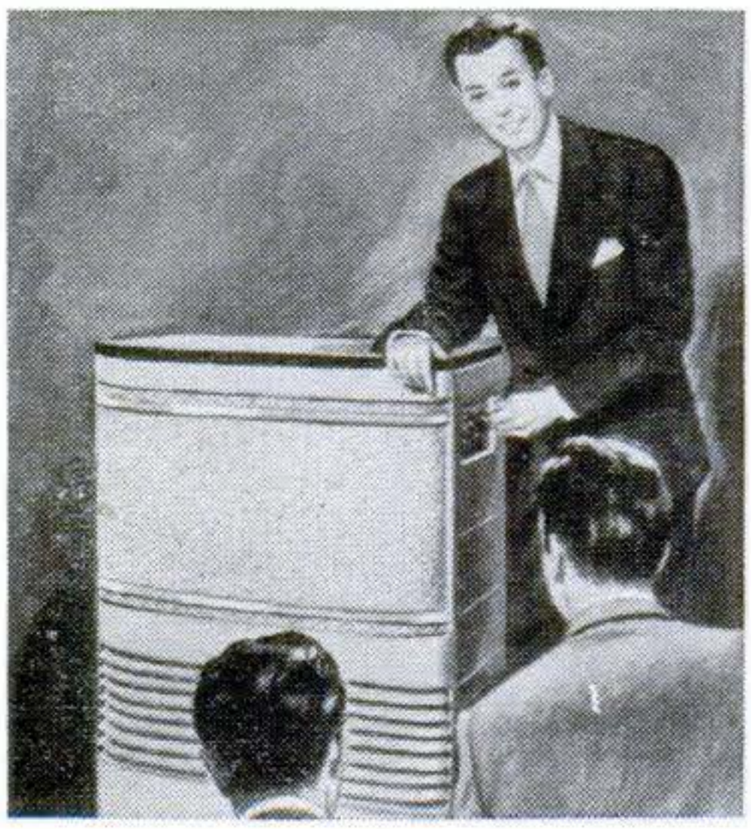
# *Music lovers'* **"horn of plenty"**

For years, working toward the ultimate in sound reproduction, scientists have sought for *living presence* — the illusion that a real musician or speaker is talking, singing, playing in your home.

Now, with RCA's Duo-Cone loudspeaker, the goal is achieved. Two cones in perfect acoustical alignment reproduce sound without distortion — give you every tonal value from a frequency of 30 on to 15,000 cycles. It is in the area above a frequency of 4,000—seldom touched by conventional speakers—that most of the all-important "overtones" lie. RCA's Duo-Cone loudspeaker faithfully reproduces every overtone, to the very peak of a violin's range, and faithfully gives you the deep low notes of a bass drum!

**In addition, the RCA Duo-Cone loudspeaker's wide angle of sound pervades every corner of a room without sharply directed blast or blare. Its response to tones of every frequency is smooth, flowing, and even.**

*See the newest advances of radio, television and electronics at RCA Exhibition Hall, 36 West 49th St., New York. Admission is free. Radio Corporation of America, Radio City, N. Y.*



Ideal for monitoring radio broadcasts—AM-FM television programs—RCA's Duo-Cone loudspeaker gets, and passes, its toughest tests from engineers and experts in sound reproduction!

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PS
The Voice of Science

# How to Tell the Truth from the Answers

DOWN at our local drugstore the other morning, the coffee drinkers nearly had a fight. It began when some of the regulars slammed down their spoons and cried, "The coffee's terrible!"

The others said they were crazy — it was even better than usual. Louis, behind the fountain, said he had just made it fresh. Then, tasting it, he got the answer: some joker had mixed a little salt with the sugar.

There is a neat lesson here for that youngest, and most important, of sciences—the Science of People. For this unintended scientific experiment revealed real facts: how many, and who, used sugar in coffee.

No pollster could have done so well with the direct question, "Do you use sugar in your coffee?" A man might ponder the reason for the question and answer evasively. A plump woman on a conversational diet might easily answer, "No."

What is needed in this struggling infant science is more salt in the sugar. More techniques to uncover truth rather than answers. For if we are to survive the impact of the other sciences on our lives, we have got to know more about how and why people behave like human beings.

I think these needed new technologies in human engineering might better start with the small daily problems. Then the techniques of interviewing and testing motivation that were developed on the little things like coffee might work better on the bigger things like bombs and international understanding.

After all, a nation is actually a collection of people conditioned by history and geography and economics. But a person is an even more fantastic collection of reactions and motives.

Even the salt-in-the-sugar test is accurate only as far as it goes. It can tell *how many* and *who*. But it cannot tell the really important truth: *why*.

I take my coffee straight, black, and strong. "Because I like it that way," is no answer. They'll need to teach me a lot more about myself to get the truth of human motivation out of the answers.

How do you like your coffee? Why?

Perry Gilkeys



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# He's riding high
# he has P.A.*

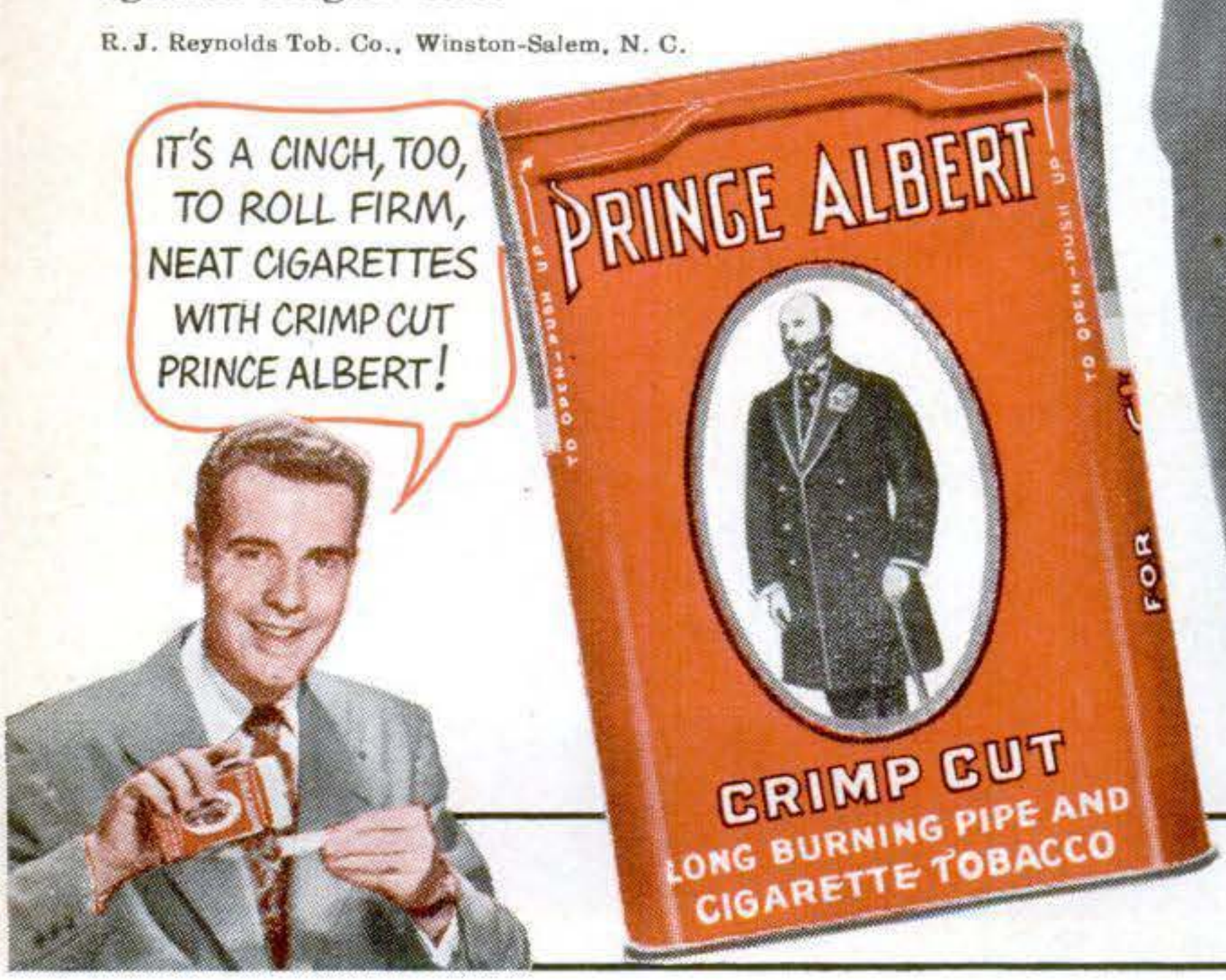
**P.A.*** means

## Pipe Appeal and Prince Albert

● Yes! He's riding high! He has Pipe Appeal which attracts admiring glances. And he has real smoking pleasure with mild, rich-tasting Prince Albert—America's largest-selling smoking tobacco.

Try P.A.! The choice, crimp cut tobacco used in P.A. is specially treated to insure against tongue bite.

R. J. Reynolds Tob. Co., Winston-Salem, N. C.




**The National Joy Smoke**



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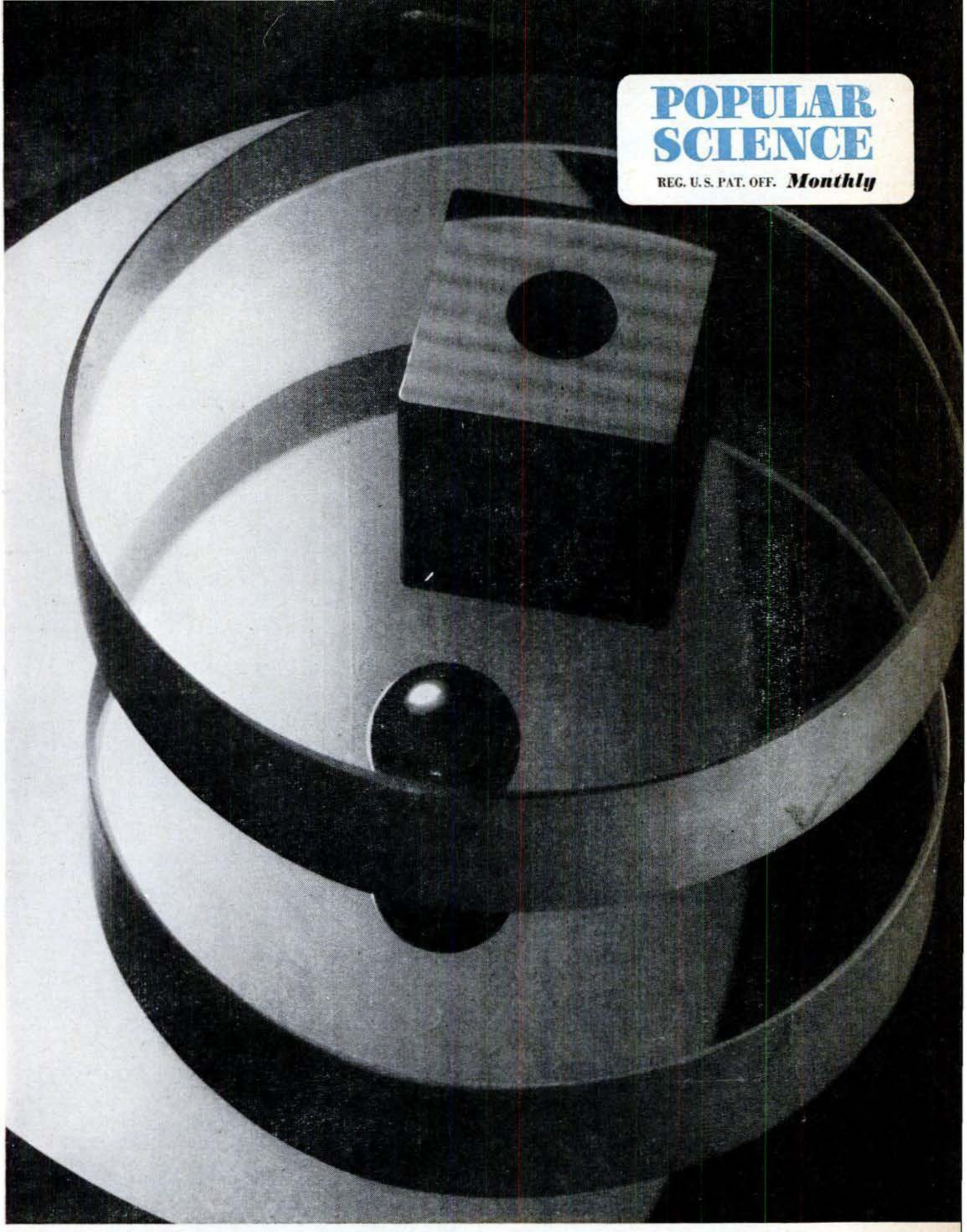


***Measuring with Light...*** Here's how the Armour Research Foundation measures the diameter of a ball bearing—to better than a millionth of an inch. A precision gauge block of known size and the ball bearing to be measured are placed side by side on a flat, optical-glass plate. Then a second glass plate is placed on top. If the bearing is either higher or lower than the gauge block, the top plate will be slightly tilted. Light rays passing through the tilted glass cause interference patterns indicating the amount of tilt—and the difference in heights. In the photo above, the seven dark interference **bands show that the bearing's diameter is .000081 inches less than the block's height.**



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**Two nylon-wrapped reasons why automatic shifts, like Chevrolet's shown above, are here to stay. More women in the left front seat, driving more miles at traffic speeds, will mean fewer clutch pedals.**



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*Cover by Ray Quigley*

***New transmissions take away part of the driver's job—and do it better than most drivers can.***

# What You Should Know About Automatic Drives

**By Devon Francis**
*Drawings by Ray Pioch*

IF YOU are buying a new car this year, you are going to be forced into making a new decision.

You may have "the best left foot in the business." You may be able to make the old heap move as smoothly as a Diesel locomotive. But from now on *you will have to make a decision about automatic drives.* You will need to know them even to say "no" to the salesman. And unless you are a rich, bachelor hermit, your eventual answer probably will be "yes."

For the robot shifts are here to stay. Like the self-starter and the closed car, they are recognition of the plain fact that the automobile is a family utility, operated by drivers of varying skill. The new drives eventually will become standard equipment because they make things easy for the dub driver, giving him the effortless performance that a taxi pilot displays.

Most of these new transmissions are optional, at extra cost initially and—probably—in running expenses. But they promise the most important advance in driving since the introduction of no-clash shifting at the close of the 1920s.

With an automatic transmission, you set a lever, press on the gas pedal, and go. Your left foot has nothing to do. The innards of the new drives take care of all the problems of delivering push at the rear wheels with relation to engine speed and grades. The car makes like an old Stanley Steamer or Walker Electric.

To give the car for many drivers this higher average driving ease, Detroit has performed nothing less than a little miracle. For all their complications, the new transmissions demand little or no more space or weight than a conventional transmission.

The new transmissions were pioneered before the war by Chrysler's fluid coupling and semi-automatic gear shifting and by Oldsmobile's Hydra-Matic. Now comes the confusion of Super-Matic, Ultramatic, Powerglide, Dynaflow, Prestomatic, and Gyromatic. Some others are so new that they haven't even been sales-named yet. But they all aim at the same thing: adapting the gas engine, weak in power and torque at low speeds, to the human driver who can best handle power with the press of a foot, just as he (or she) makes a radio louder with the twist of a wrist.

In these pages POPULAR SCIENCE presents a Who's Who of the new drives: how they work, how they differ, their advantages, disadvantages, and costs.

### *But They're Not Automatic*

None of these new transmissions is actually "automatic." They are neither shift-free nor gearless. Even in the simplest, the selector quadrant on the steering column presents the driver with three choices, and most of them present five: (1) park, (2) neutral, (3) emergency low, (4) normal forward drive, and (5) reverse. Freedom from shifting exists only after the lever is flicked into the "drive" position. Even so, driving is not shift-free in snow, mud, or on steep hills. The very latest transmissions have those old solid gears for emergency low and reverse.



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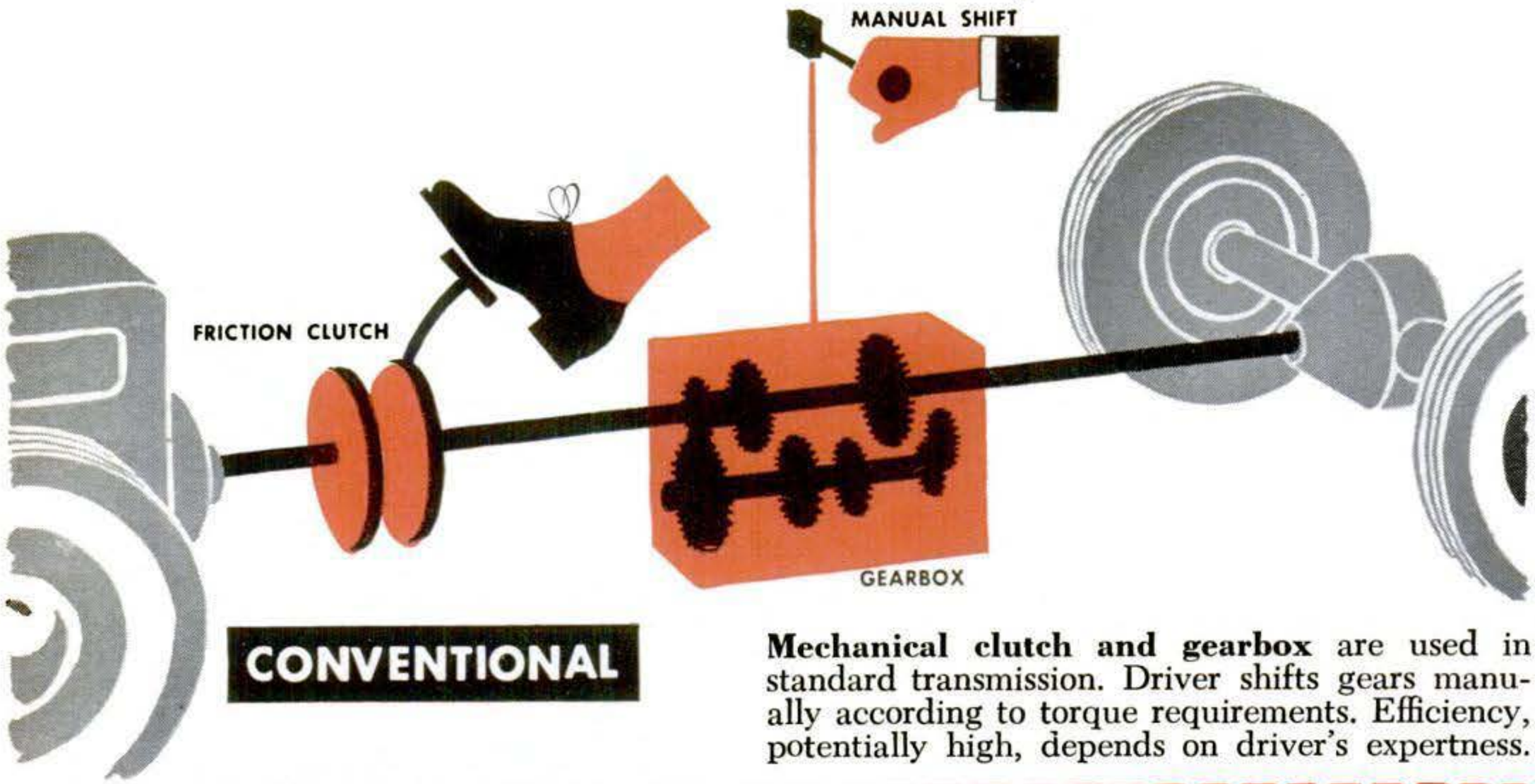
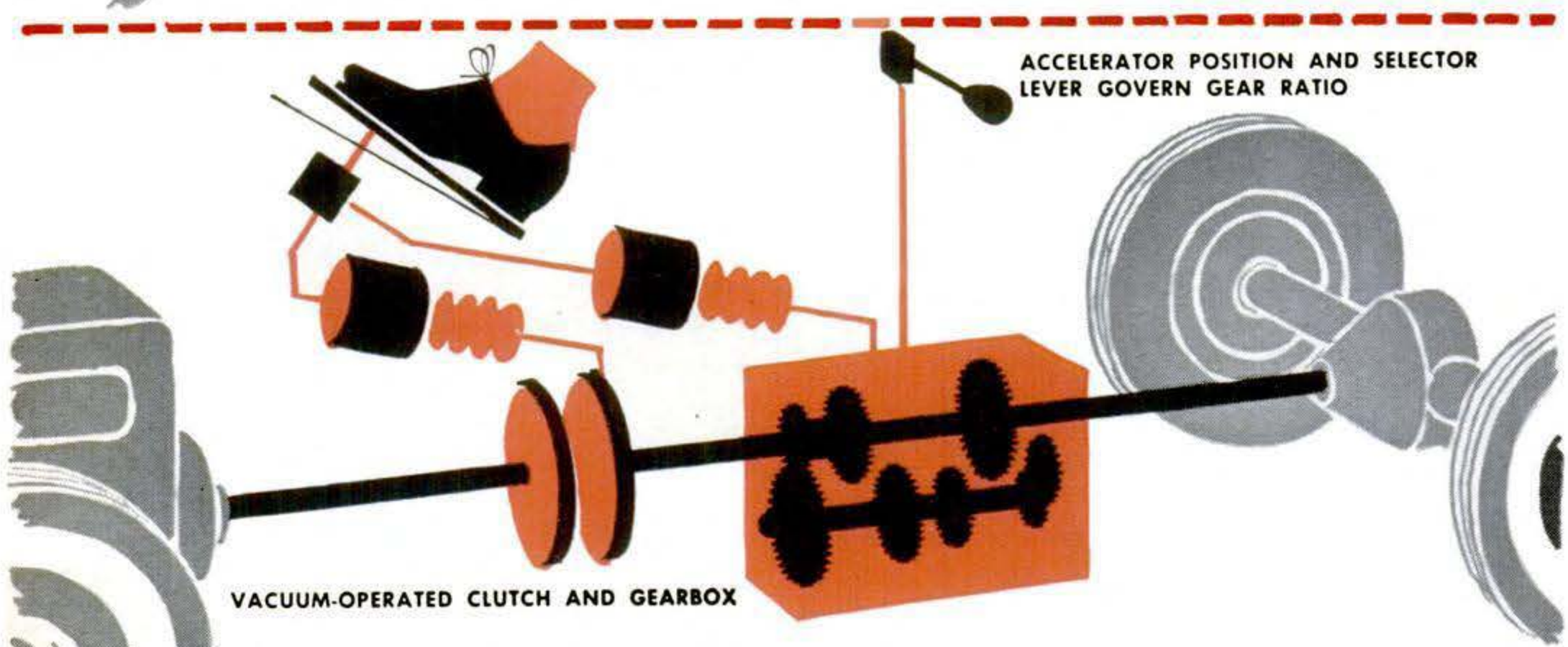



**CONVENTIONAL**

**Mechanical clutch and gearbox** are used in standard transmission. Driver shifts gears manually according to torque requirements. Efficiency, potentially high, depends on driver's expertness.




**HUDSON**

**Hudson** has semi-automatic drive, like Chrysler (next page). In drive range Hudson up-shifts pneumatically from getaway gear to high. With overdrive cruising ratio, it's called Super-matic.

Some of the new drives use automatic gear trains as an adjunct to torque converters for an extra boost from a standing start. Hydra-Matic, oldest of the "self-shifting" transmissions, is a gear job throughout except for its fluid coupling.

The hydraulic torque converter, heart of several newer transmissions, is a fluid gearbox. It simply substitutes the hydraulic advantage of pump-powered turbines for the mechanical advantage or leverage of steel gears. It also gives an infinite number of ratios, compared to the three in a conventional low-second-high transmission.

### *Make Them Shift for Themselves*

In engineering an automatic transmission, the aim of the auto makers was to get that familiar H-type shift and clutch pedal out of the driving compartment. They have accomplished this in two ways. The first, and most obvious, way was to make the gears shift themselves (PS, Dec. '45, p. 142). Overdrive (PS, Apr. '49 p. 180) is a small semi-automatic transmission giving an extra high gear tacked on a conventional one. Shifting within but not between the low and high ranges is automatic in some Chrysler Corp. transmissions. All ordinary forward driving with Hydra-Matic is automatic.

The second way is the torque converter, trade-marked Dynaflow on its first introduction to the American private-car market (PS, Feb. '48, p. 113). A new combination of gears plus torque converter is the latest in automatic transmissions. PS readers know that Dynaflow and Packard's Ultramatic (PS, June '49, p. 139) have in common not only torque converters but several other features as well. So do Chevrolet's Powerglide and the automatic transmissions of Studebaker, Ford, and Mercury. It is the



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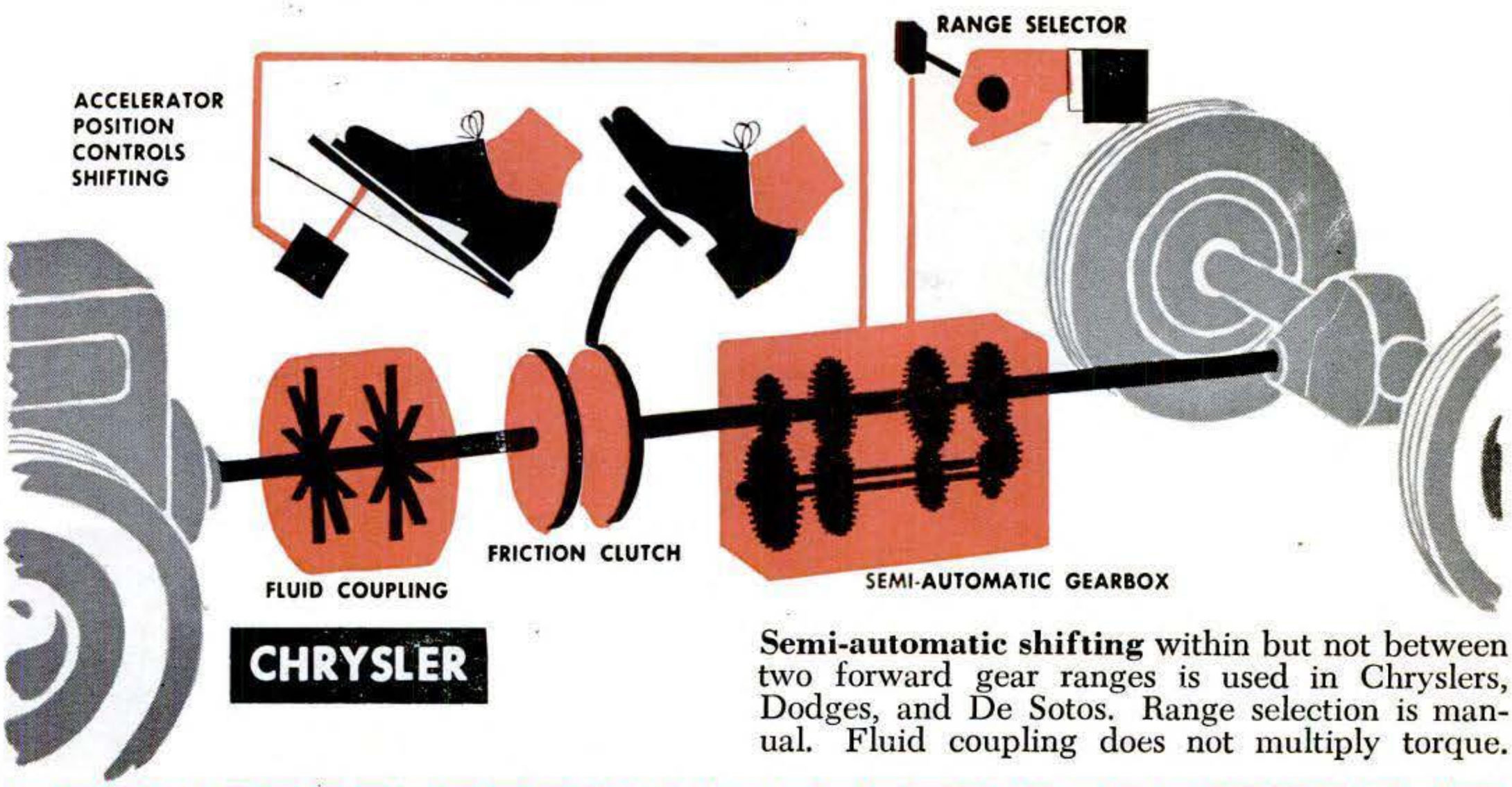
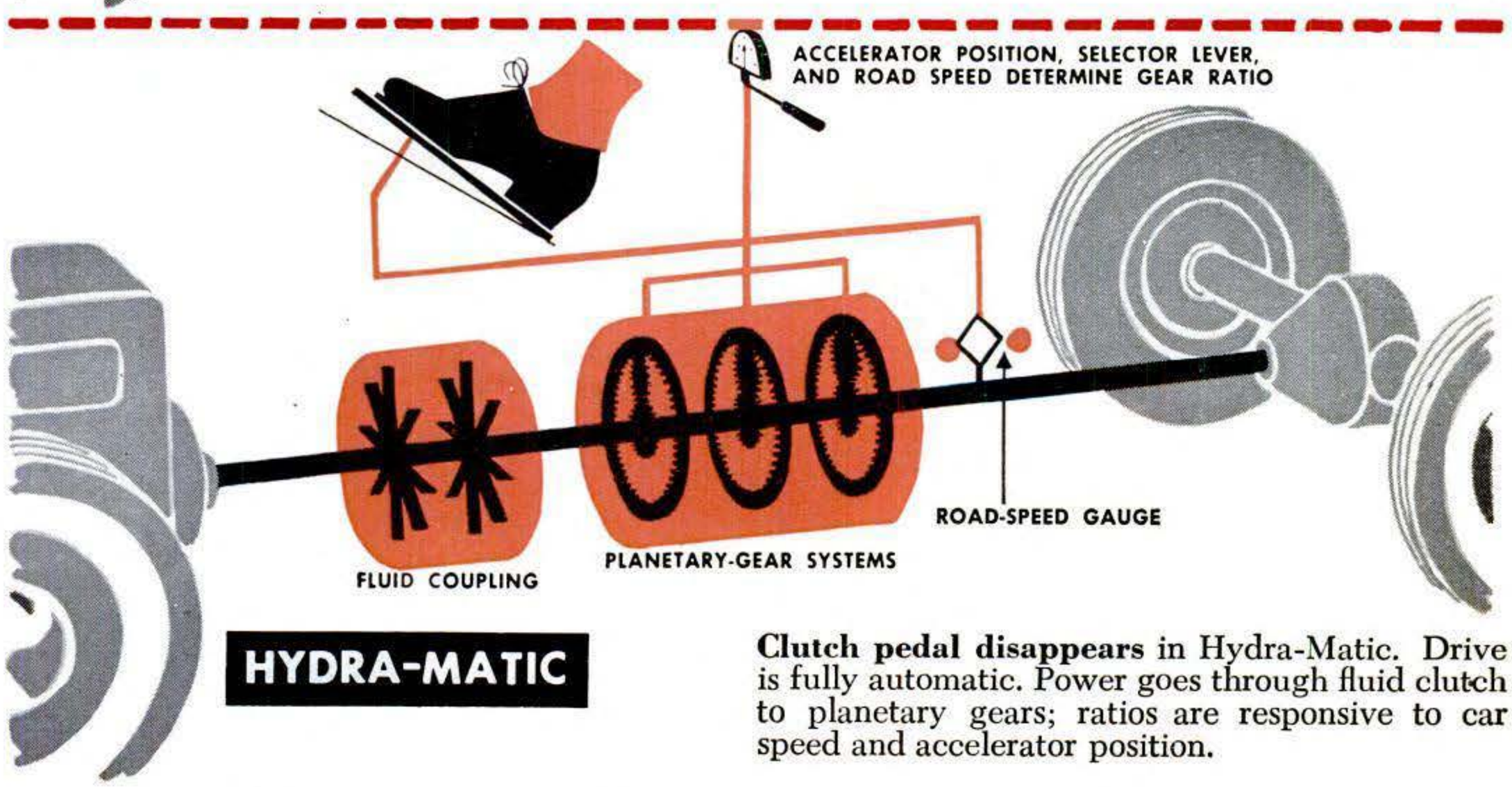



**Semi-automatic shifting** within but not between two forward gear ranges is used in Chryslers, Dodges, and De Sotos. Range selection is manual. Fluid coupling does not multiply torque.




**Clutch pedal disappears** in Hydra-Matic. Drive is fully automatic. Power goes through fluid clutch to planetary gears; ratios are responsive to car speed and accelerator position.

*way* the individual manufacturers combine these basic principles that makes them different.

The new transmissions are neither simple in construction nor simple to understand. They are almost literally built like a watch. No Sunday mechanic can tear one down, put it together, and drive it Monday morning. They're complex because they have to perform a lot of functions that heretofore were performed by hands and feet made dexterous by habit. They must also, within themselves, mend some of their own inherent faults. This explains in part why the automatic transmission took so long to move out of the luxury price bracket.

Here are some of the complicating elements that are packed into the new drives:

- The hydraulic torque converter.
- One or more planetary-gear systems (borrowed from the Model-T Ford.)
- Gear-action oil pumps.
- One or more multiple-disk clutches.
- A series of band-type transmission brakes.
- A hydraulic valve block assembly.
- A master-plumber's nightmare of pipes carrying oil under high pressure.

The torque converter and the planetary gears drive the car by transmitting and multiplying engine torque. What elements do *what* and *when* depends on speed, load conditions, and what brand of transmission you are driving.

### *Controlling the Controls*

All the rest of the stuff in an automatic transmission comprises the *regulation* and *control* systems. The *pumps* maintain pressure in the plumbing. The *clutches* change gear ratio and direction of rotation by seizing and releasing planetary parts at the



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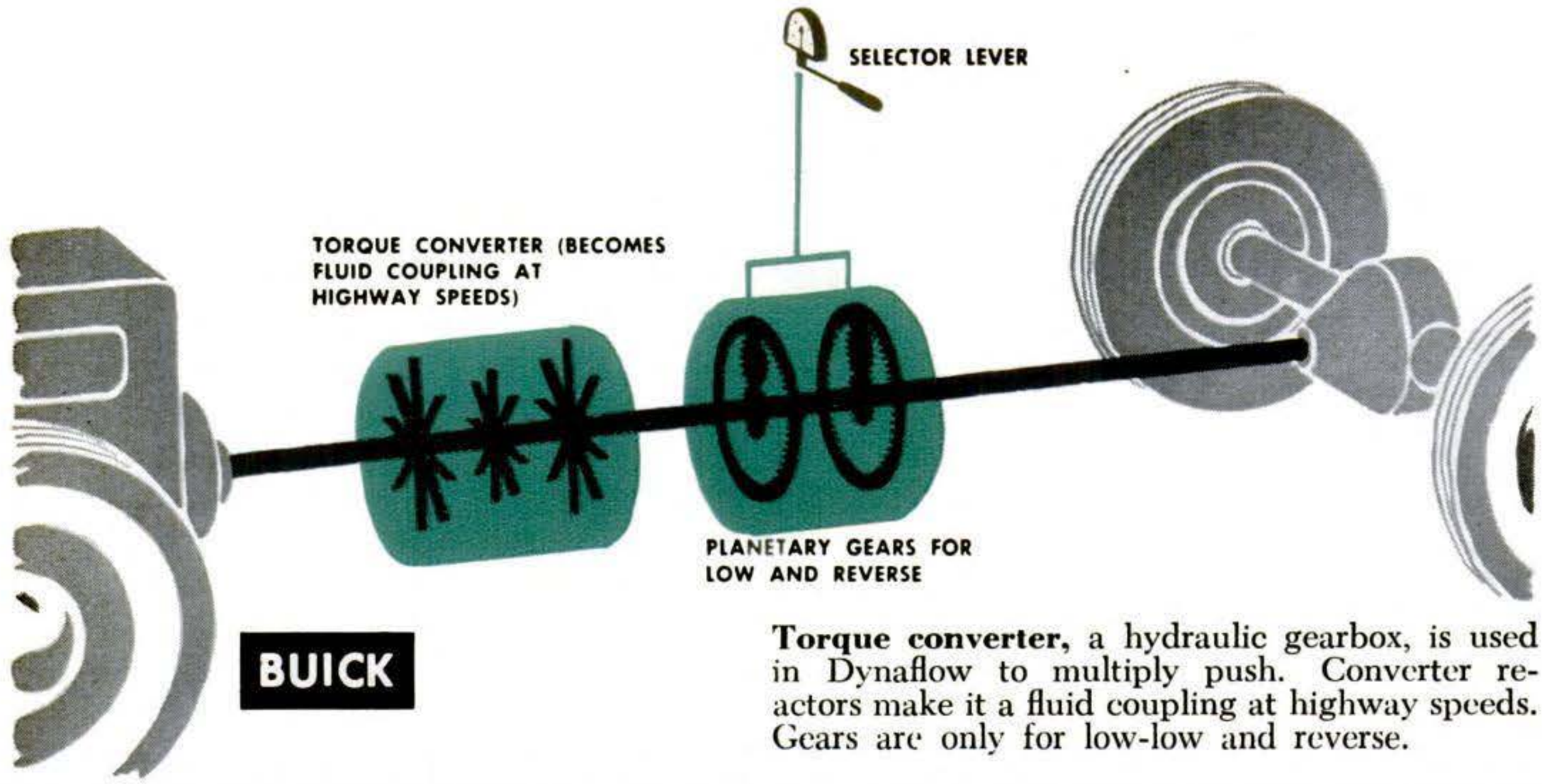
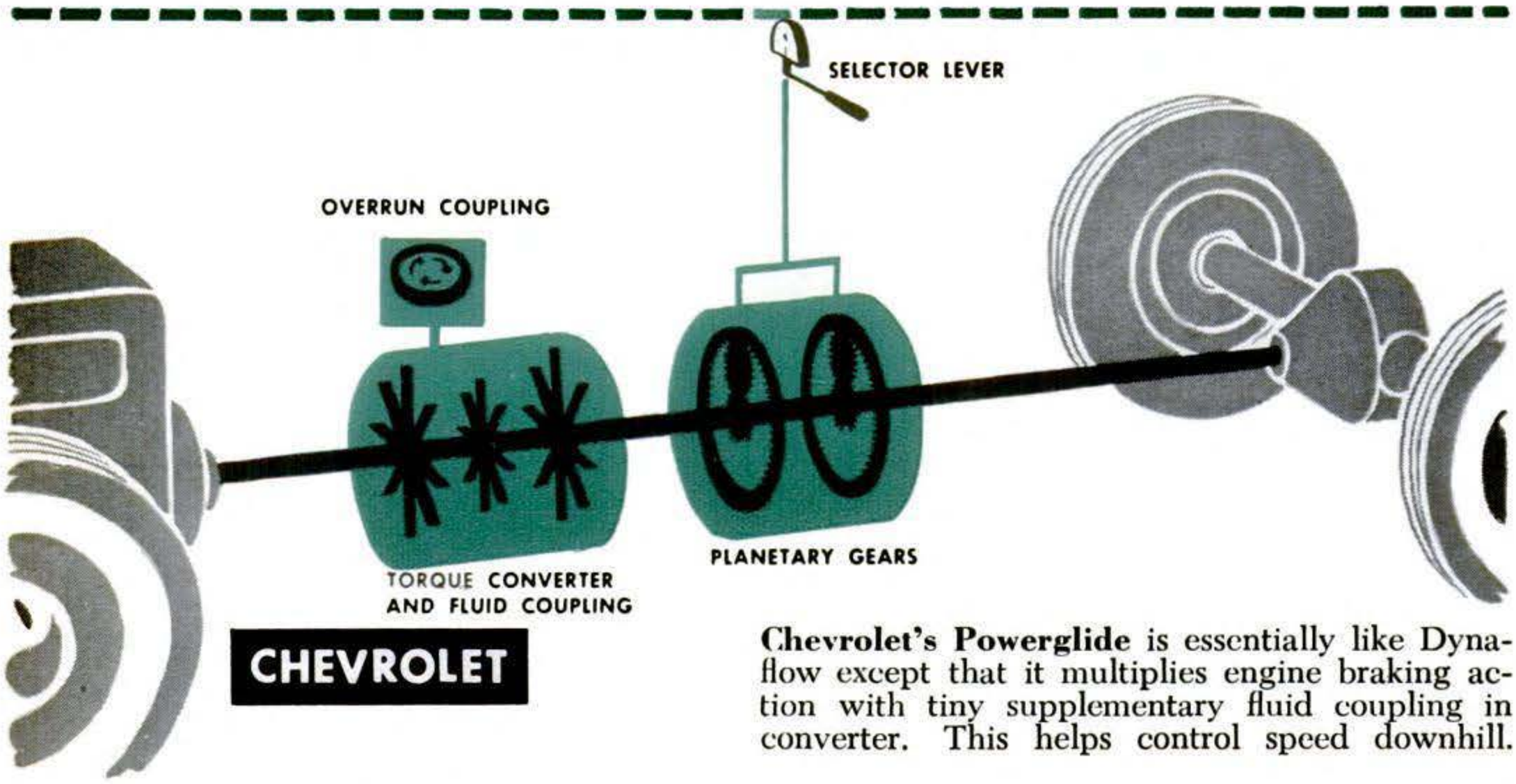



**Torque converter,** a hydraulic gearbox, is used in Dynaflow to multiply push. Converter reactors make it a fluid coupling at highway speeds. Gears are only for low-low and reverse.




**Chevrolet's Powerglide** is essentially like Dynaflow except that it multiplies engine braking action with tiny supplementary fluid coupling in converter. This helps control speed downhill.

proper moments. The *valves* regulate oil pressure and act as *selectors* to switch the power train through the transmission.

Most of the new drives have, besides the items listed above, a centrifugal *governor*. This is half of a team in the control system. The other half is the driver's accelerator pedal. Between them, they interpret the torque and speed you demand and go around or through the elements in the transmission accordingly.

Studebaker and Packard have a single-plate disk clutch not unlike the clutch in a car with a conventional transmission. This is used to lock up everything in the transmission and provide a direct *mechanical* connection between engine and differential, eliminating hydraulic "slip."

Old automotive words have taken on new meanings. In the new transmissions, "brakes" and "bands" are not those for the car's wheels but, instead, for gears. "Clutches" in the planetary systems are only second cousins to the clutch that responds to the pedal under the left foot. "Valves" have not to do with the engine's cylinders but with the hydraulic system. "Free-wheeling" can mean *gear*-wheeling, not coasting on the highway.

### *The Manufacturer Says . . . .*

Once you get past the torque converter, the most fascinating parts of the new transmissions are the planetary-gear systems and the pipe lines that cause them to deliver, or help multiply, engine torque to the rubber on the road. Here, for example, is the factory's explanation of what happens in the Studebaker in "emergency low"—and if you understand it readily, you will be doing better than most of the engineers in the industry itself:



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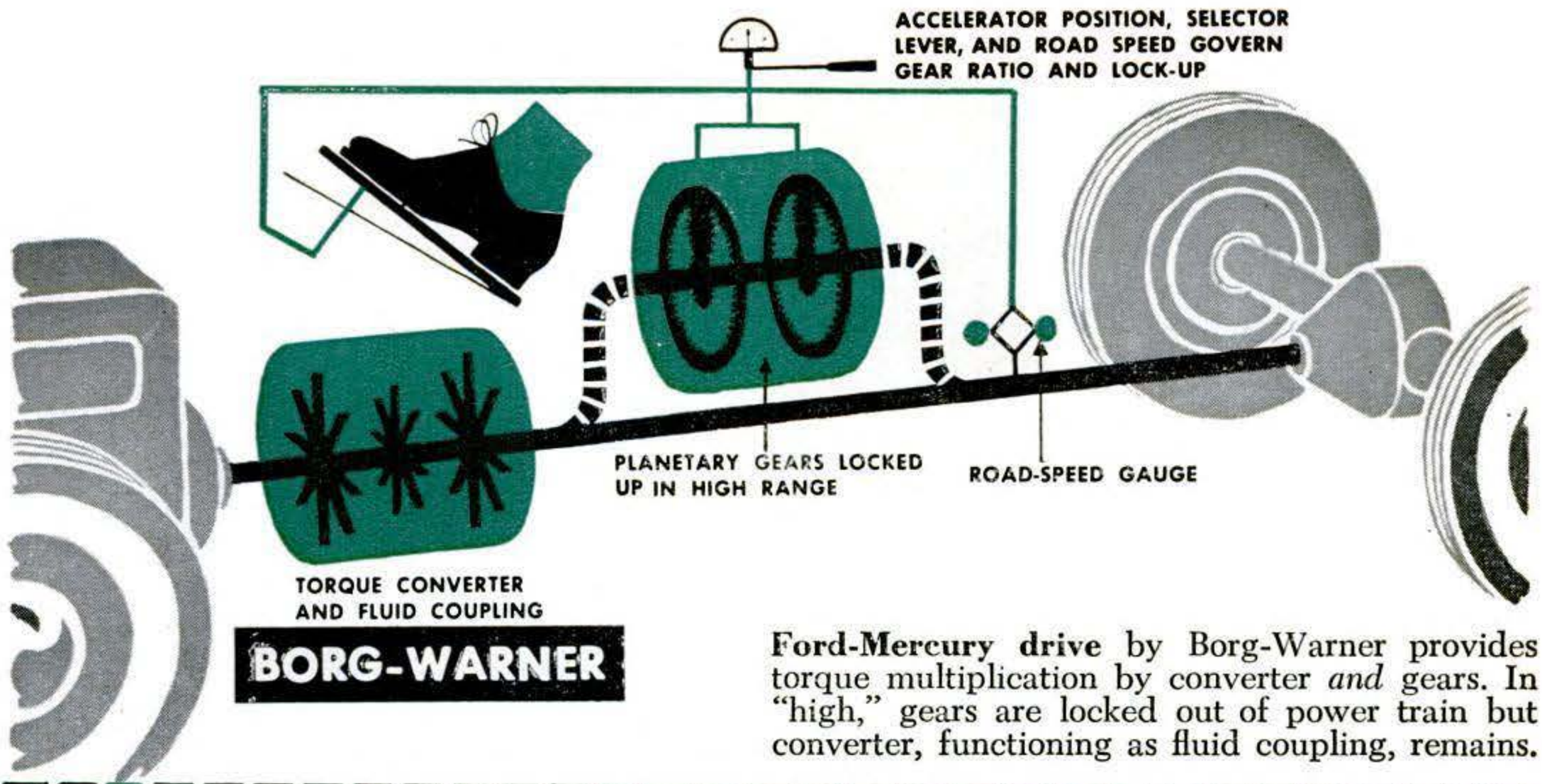
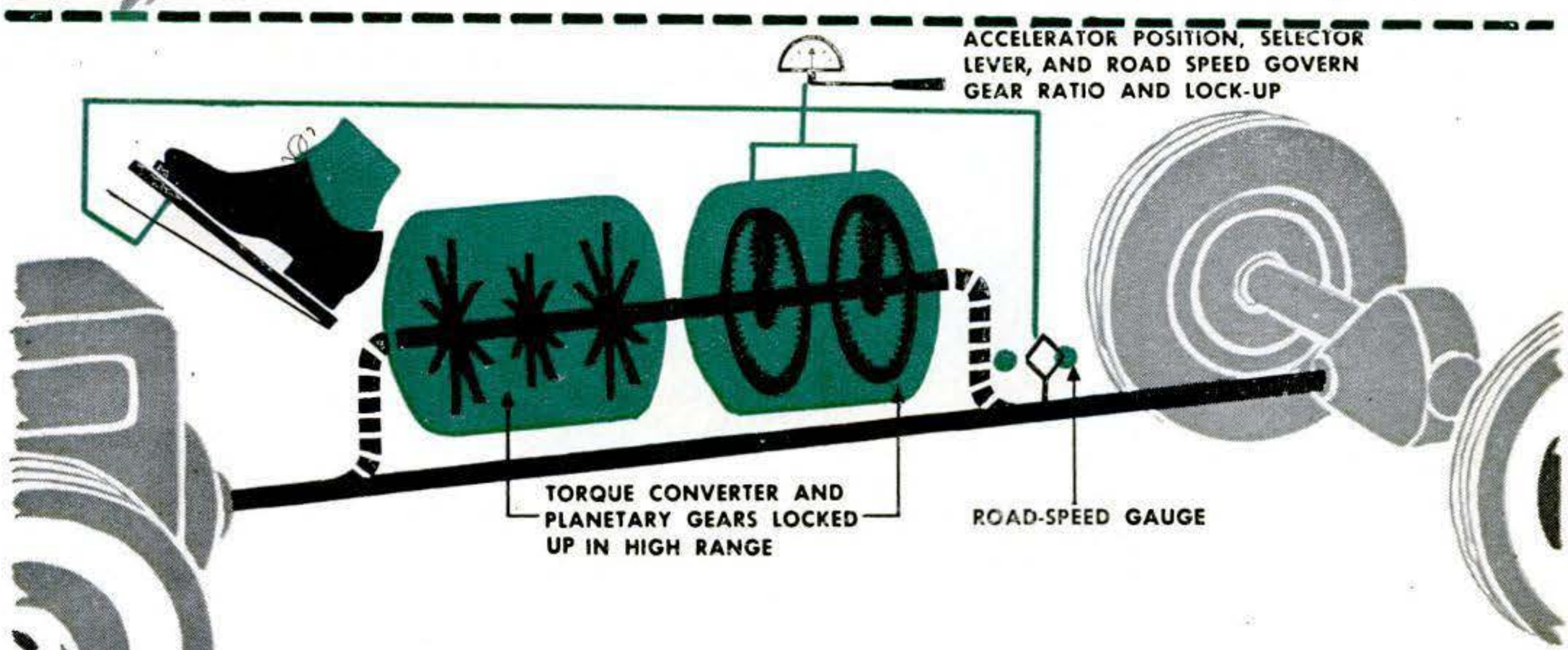



**BORG-WARNER**

**Ford-Mercury drive** by Borg-Warner provides torque multiplication by converter *and* gears. In "high," gears are locked out of power train but converter, functioning as fluid coupling, remains.




**PACKARD**

**Lock-up** is employed by Packard, like Studebaker (see page 110). Both converter and gears boost torque at getaway, but they are automatically disconnected in "high," when the drive is direct.

A *lockup band* and *forward drive band* are applied through their *hydraulic servo mechanisms.* The *lockup band* holds the *sun gear* of one of two *planetary* sets stationary, while the *forward band* holds stationary the *sun gear* of a *second planetary* set through a *free-wheel unit* fitted with *sprags* to prevent *counter-rotation.* The *power flow* is from the *turbine* shaft of the *torque converter* to the *ring gear* of the *first planetary set.* In a simple *planetary-gear system,* a forward ratio drive is effected through the *planet carrier* when the input is through the *ring gear* and the *sun gear* is held *stationary.* The two *planetary sets* function alike, but the second one effects a different ratio due to different numbers of teeth. The total gear ratio in first gear is the product of these two ratios in the planetaries, or 2.308 to 1. The *combination* of this *gear reduction* and the *torque multiplication* in the *converter* as the car starts gives a maximum ratio of 4.96 to 1 at the rear axle.

But you actually get a torque effort of better than 17½ to 1 in emergency low. How come? Well, you multiply the *gear reduction* in the planetaries times the *torque boost* in the converter *times* a rear-axle ratio of 3.54 to 1.

### *Gas Economy? Servicing? Performance?*

No, the new transmissions are not simple. And the differences among them are going to supply no end of argument around the gas pumps for many years. Bear in mind that these differences reflect honest divisions of opinion among design engineers. One engineer is a nut on servicing economy, another on gas economy. Still another wants getaway performance. In the end every engineer has to compromise, and it is the differences in the compromises that produce the differences in drives.

Dynaflow, which has no torque multi-



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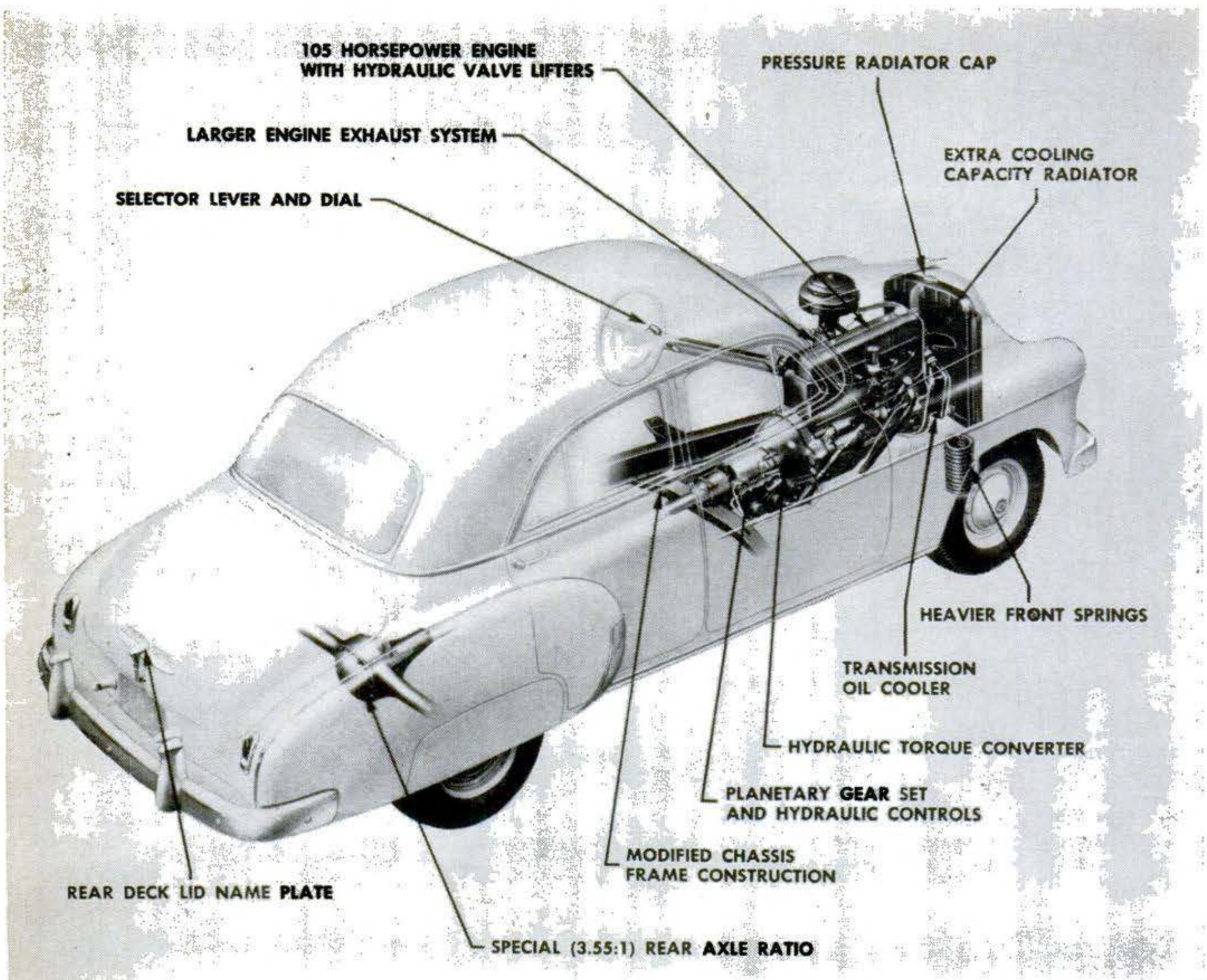


**Modifications** involved in putting a torque converter in 1950 Chevrolet are shown here. More power, transmission oil cooler, and change from 4.11-to-1 rear-axle ratio are important ones.

plication by gear when the car is in the driving range, has the great virtue of relative simplicity. But Dynaflow requires more engine power if the rear-axle ratio is to be kept within economical limits. Chevrolet's Powerglide is like Dynaflow except that it incorporates an extra gizmo in the torque converter to afford extra engine *braking* power in going downhill. Chevvy must pay for that advantage in forward-driving efficiency, if ever so slightly.

### *They're All Different*

In the interests of simplicity, Ford and Mercury will have no mechanical lock-up, as Packard and Studebaker do, to by-pass the torque converter for direct, mechanical drive once the car gets rolling.

Who's right—Ford, or Packard and Studebaker? Oldsmobile and its licensees (Cadillac, Pontiac, Nash, Lincoln, Kaiser, Frazer) cling to automatic gear drive without fluid torque multiplication. Who's right? Chrysler and Hudson as yet haven't given complete "automatic" drive a tumble. Who's right, for whom, for how much?

What has been gained, now that the new automatic transmissions are here? Their drawbacks are plain. In ordinary driving, even the best of them give slightly less gas mileage than conventional gearboxes.

### *Heat Is a Problem*

It takes extra gas to move that extra machinery, and heat energy is built up inside the torque converter that is dissipated into the air. In fact, some of the new transmissions have a special radiator to get rid of the heat. On sizzling days some torque converters over-heat. The oil in them froths. The air content cuts the density and reduces the amount of torque transmitted to the rear wheels.

Almost all of the new drives "creep" at the stoplight, especially when the engine is cold and is kept at a fast idle by the automatic choke. A firm foot must be kept on the brake pedal until the light turns green.



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The first price of an automatic transmission is higher. It will come down, but it probably will be years before it is as cheap as a conventional shift. For a long time, servicing is bound to cost more.

Although designed to make the dub a smooth driver, the new transmissions will require even the experts to re-school themselves for best performance or best gas mileage. They must be pushed briskly—18 or 20 m.p.h.—when the battery won't start the engine, **and shouldn't be** towed to start, unless you want to risk smacking the towing car when the engine catches. Snow-driving must be relearned. The selector lever must be treated with the same caution as the old clutch pedal and shift lever.

But the "disadvantages" of the new drives are outweighed by their advantages. Efficiency may be below that of an *ideally* manipulated manual shift, but it'll be a lot better than that turned in by the dub—or the lazy expert. Moreover, the cushioning fluid absorbs a lot of driving stresses, with consequent long-run savings. Eventually, automatic drives will let the driver forget his car and concentrate on the road. That ought to make driving a lot safer. And then there's another advantage:

### *You'll Give In Eventually*

You may say no to the salesman this year when he suggests an automatic drive. But be wary if the man who lives across the street buys a car without a clutch pedal. As sure as shooting, his wife is going to tell *your* wife about shift-free driving.

An automatic transmission is a great advantage if it only keeps peace in the household. END

## BOX SCORE OF AUTOMATIC DRIVES

**This chart shows the availability and prices of factory-installed automatic and semi-automatic drives and overdrives on 20 U. S. cars. Where models are not specified, the notation applies to all of that make. Prices are those recommended to dealers and are listed only where the drive is optional equipment. They do not include excise or sales taxes.**

| CAR | DRIVE | STANDARD/OPTIONAL | PRICE | OVERDRIVE | PRICE |
|---|---|---|---|---|---|
| BUICK | Dynaflow | Standard on Roadmaster only | $160 | Not offered | |
| CADILLAC | Hydra-Matic | Standard on 62 Series and 60 Series Special only | 174.25 | Not offered | |
| CHEVROLET | Powerglide | Optional on DeLuxe only | 150 | Not offered | |
| CHRYSLER | Prestomatic | Standard except on Royal | 120 | Not offered | |
| CROSLEY | | Not offered | | Not offered | |
| DE SOTO | Tip-Toe Shift | Standard on Custom only | 120 | Not offered | |
| DODGE | Gyromatic | Optional | 94.60 | Not offered | |
| FORD | Borg-Warner | To be optional | 150 (est.) | Optional | $ 96.90 |
| FRAZER | Hydra-Matic | Optional | * | Optional | 91 |
| HUDSON | Super-matic<br>Drive-master | Optional<br>Optional | 189.50<br>99.50 | Optional | 90 |
| KAISER | Hydra-Matic | Optional | * | Optional | 91 |
| LINCOLN | Hydra-Matic | Optional | 174.25 | Not offered | |
| MERCURY | Borg-Warner | To be optional | 150 (est.) | Optional | 100 |
| NASH | Hydra-Matic | Optional on Ambassador only | 158.50 | Optional | Statesman 93.50<br>Ambassador 99.80 |
| OLDSMOBILE | Hydra-Matic | Optional | 158.50 | Not offered | |
| PACKARD | Ultramatic | Optional on Custom only | 185 | Optional | 92 |
| PLYMOUTH | | Not offered | | Not offered | |
| PONTIAC | Hydra-Matic | Optional | 158.50 | Not offered | |
| STUDEBAKER | Borg-Warner | Optional on Land Cruiser and Commander only | * | Optional | Land Cruiser 93<br>Commander 93<br>Champion 87 |
| WILLYS | | Not offered | | Standard on 4- & 6-cyl. station wagons and Jeepsters; not otherwise offered | |

*To be announced



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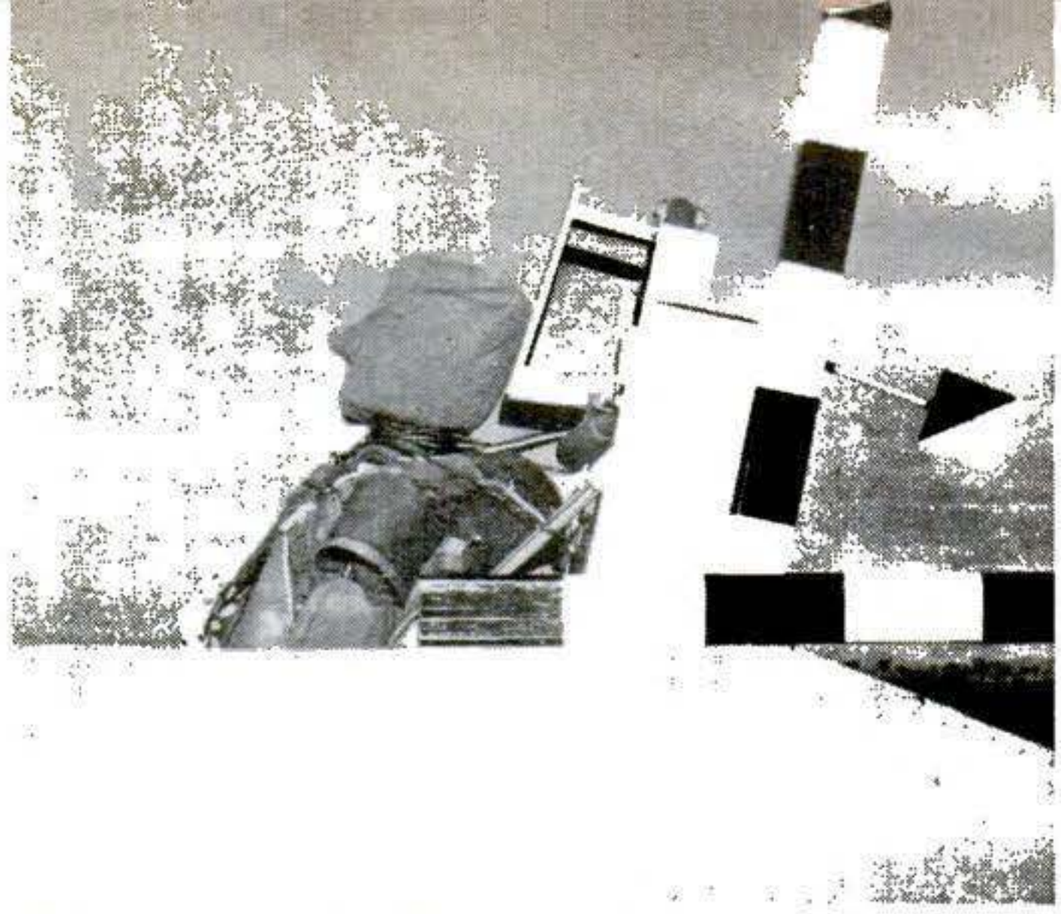
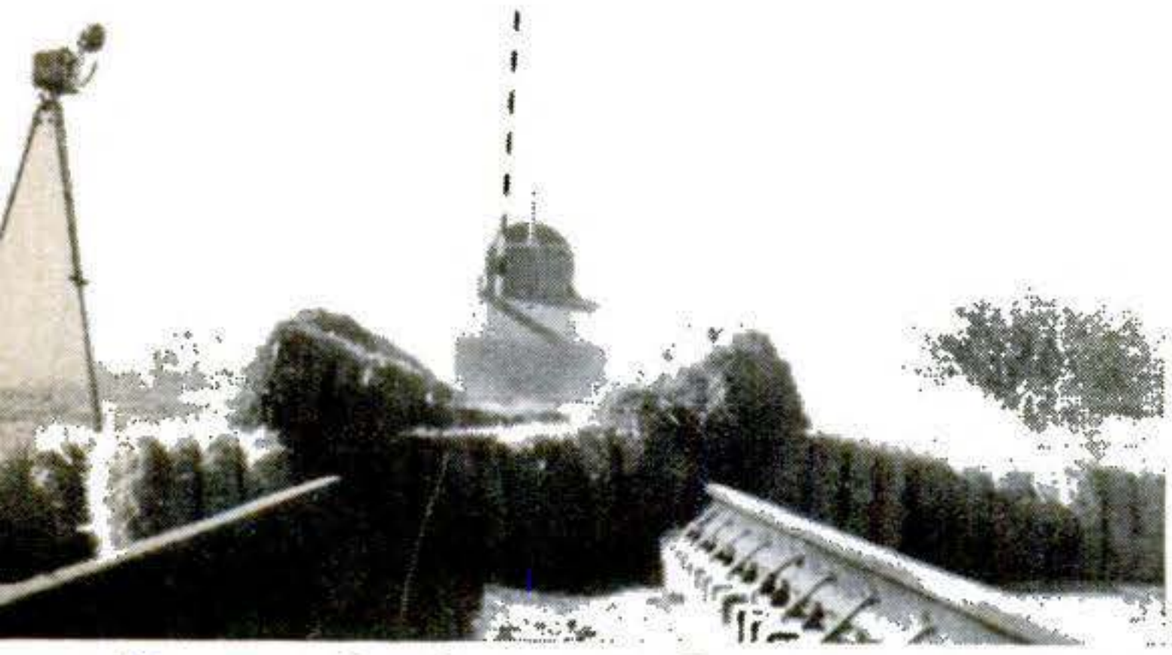


# Fastest Car Tests Jet Pilot's Seat

**"Barber poles"** aid in time-position calculations based on high-speed movies of seat ejection. Electronic telemetering equipment records all forces acting on the dummy figure during flight.

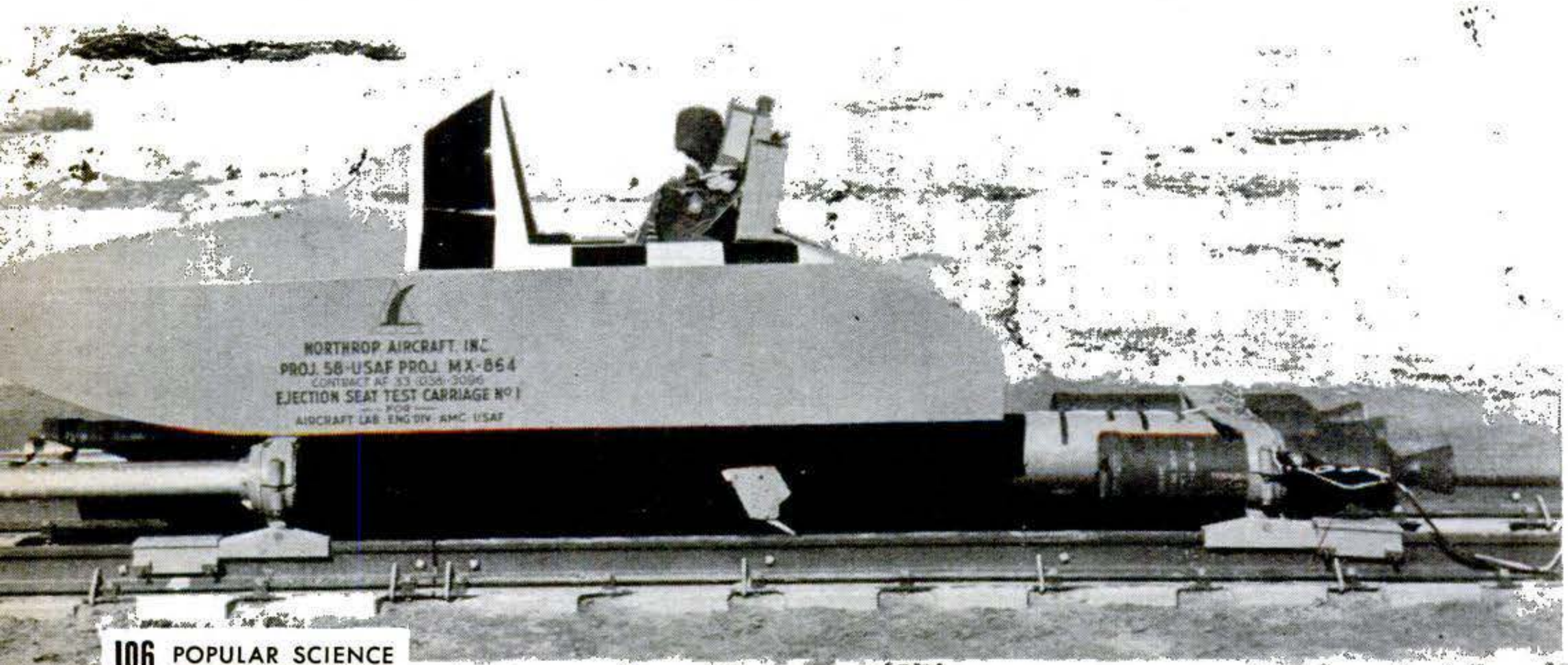
YOU'D have to be a dummy to allow yourself to be shot sky high in a jet fighter's ejection seat at more than 1,000 miles an hour. That's what the Air Force figured, so they're using a "straw man" to dummy for pilots in experiments to find out the effects on a man in escaping from an aircraft flying faster than sound.

In tests being conducted in conjunction with Northrop Aircraft engineers at Edwards Air Force Base, at Muroc, Calif., a 180-pound dummy is strapped into a standard ejection seat used in the F-89 Scorpion jet interceptor. The dummy is then catapulted aloft while a rocket-propelled sled speeds along a two-mile track at up to 1,100 m.p.h. Experiments so far indicate that a man can be shot out of a jet plane at 700 m.p.h. without injury. At greater speeds is is believed that added safeguards must be provided—perhaps a capsule in which the pilot is sealed. Another method being tried is to eject the pilot through the floor of the plane, thus avoiding any possible contact with the craft's tail surfaces.



**Up goes the dummy** in his ejection seat, high above the track-bound rocket sled, which is not moving in this demonstration. Bales of hay, not used in speed runs, cushion dummy's fall.

**This 2,300-pound sled** races at speeds up to 1,100 m.p.h., propelled by rear rocket units. After dummy has been shot aloft, front decelerating rockets brake sled to stop.



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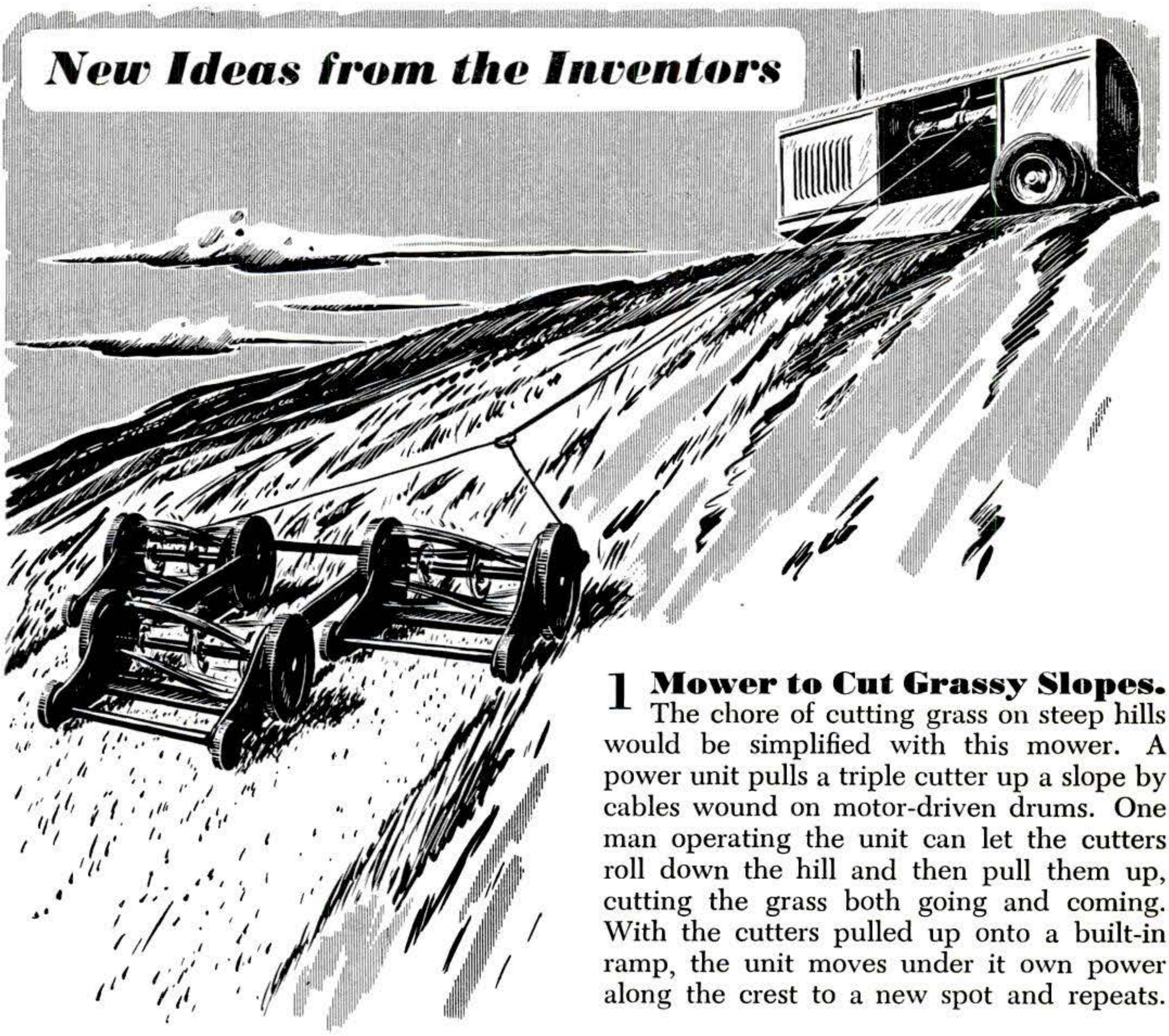
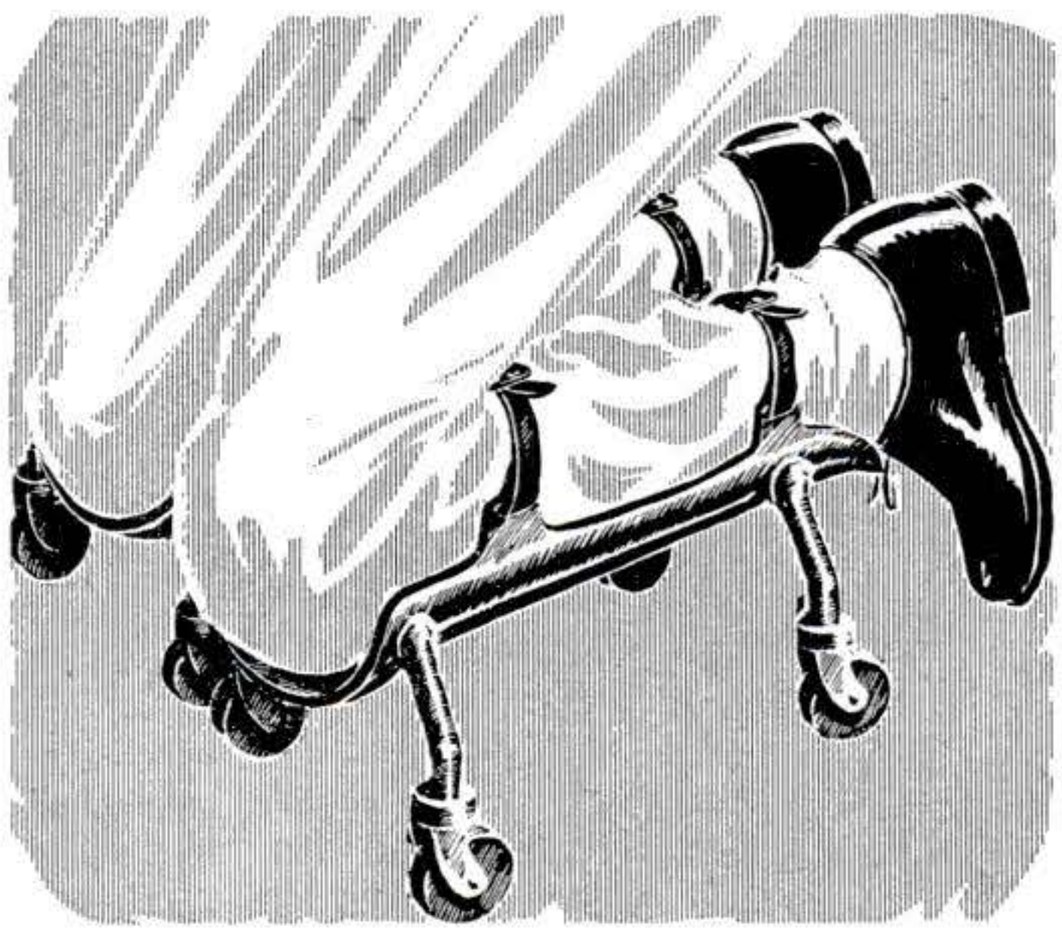
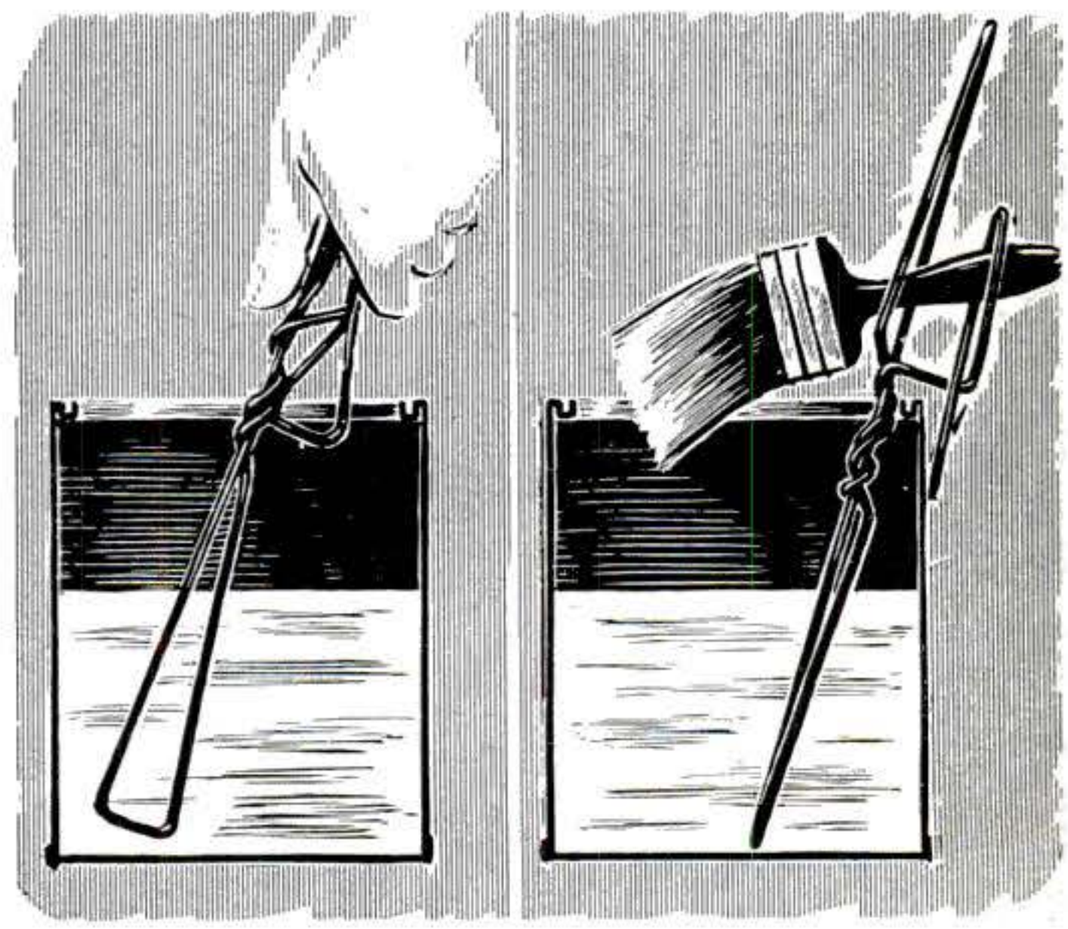
# New Ideas from the Inventors



**1 Mower to Cut Grassy Slopes.** The chore of cutting grass on steep hills would be simplified with this mower. A power unit pulls a triple cutter up a slope by cables wound on motor-driven drums. One man operating the unit can let the cutters roll down the hill and then pull them up, cutting the grass both going and coming. With the cutters pulled up onto a built-in ramp, the unit moves under it own power along the crest to a new spot and repeats.



**2 Leg Dollies to Save Knees.** Designed for use by workmen who must kneel for long periods at a time, these wheeled leg supports would permit the wearer to move easily while kneeling, yet would not interfere with normal standing or walking. The casterlike wheels are swiveled so they will roll in any direction.



**3 Stirrer to Hold Brush.** Made from a single piece of wire, this paint stirrer also will double as a handy paint-brush holder. A second, smaller loop offset from the handle loop allows the tool to be hooked over the rim of a can when not in use. The tops of the two loops then form a convenient rack for a dripping brush.

*Turn the page, please, for three more new ideas*



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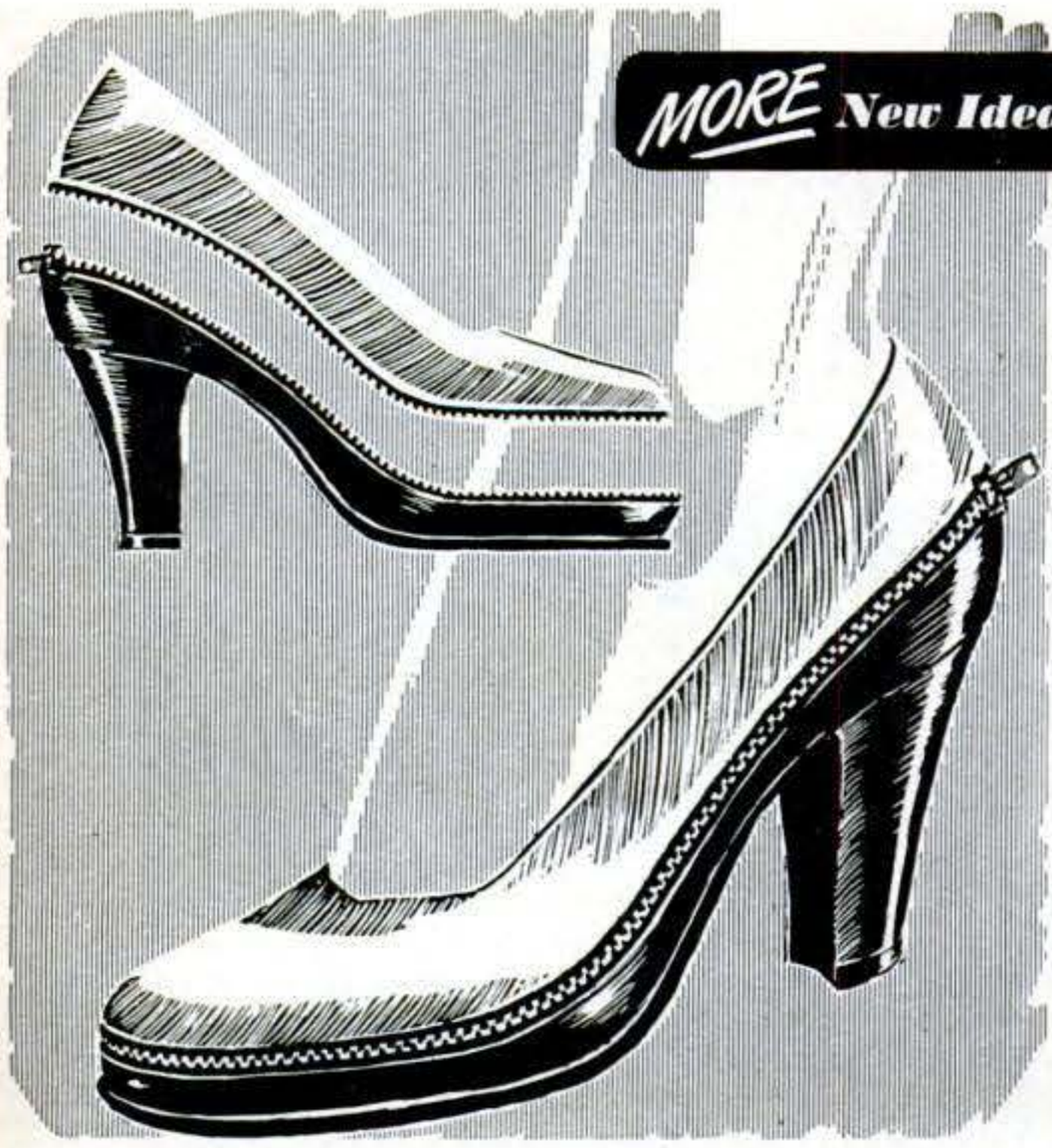
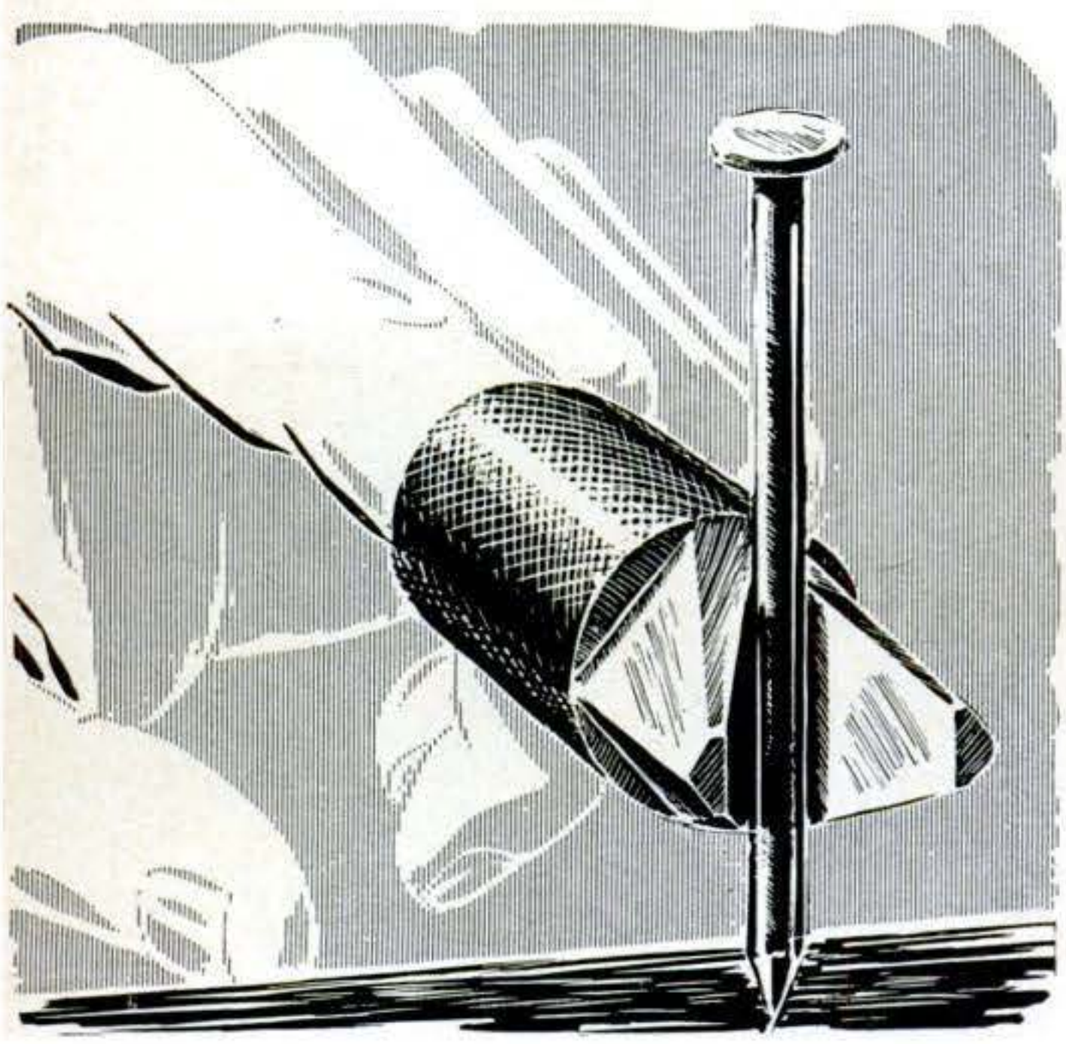
# MORE New Ideas from the Inventors



**4 Shoe Tops to Zip On.** One pair of lowers and an assortment of uppers would take care of a woman's footwear needs with these shoes. The uppers, in a variety of colors and designs, could be interchanged easily, thanks to a slide fastener completely encircling each shoe. One kit could replace many pairs of shoes.



**5 Magnet to Hold Nails.** You'd have a lot less trouble driving nails—and fewer smashed fingers—with this magnetic holder. Fitting on the end of a finger like a thimble, it has a magnetized-metal head with a V-shaped groove in it that attracts and holds a nail while it is being started in the wood and driven home.

**6 Air Target to Train Pilots.** This gunnery target is designed to be tossed from a plane as a compact cylindrical bundle. In falling, a small parachute unrolls a streamer, unwrapping a fabric balloon that then expands automatically. A flammable powder inside the balloon ignites the target when it is hit by tracer bullets.

*Patents on these inventions have been granted to: 1. J. Ebenhoe, Manitowoc, Wis.; 2. R. Ferguson, Bristol, Tenn.; 3. G. Hoffman, Miami, Fla.; 4. F. Parlante, Great Neck, N.Y.; 5 R. Ingraham, San Antonio, Tex.; 6. F. Fleming, U.S. Navy.*



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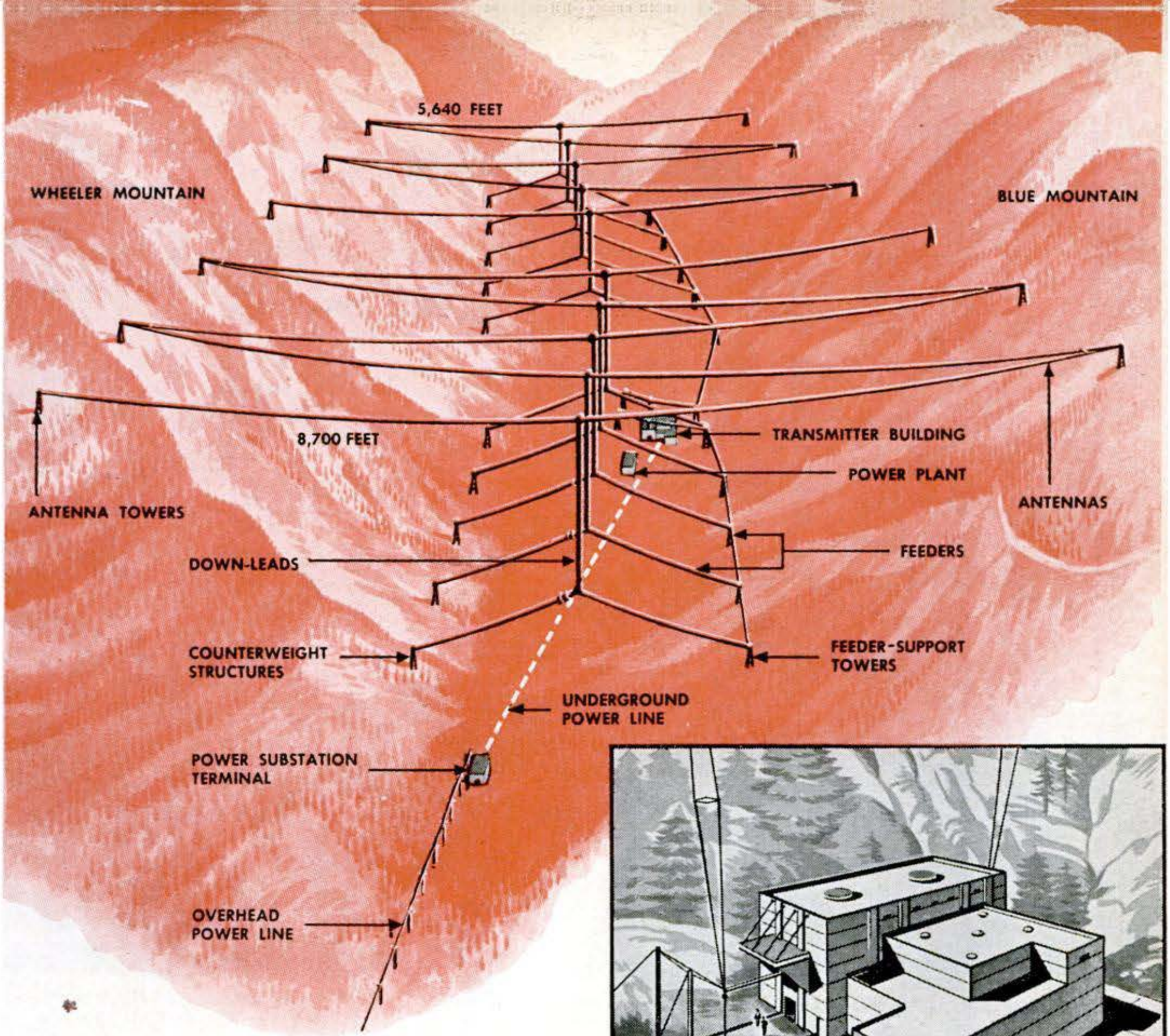
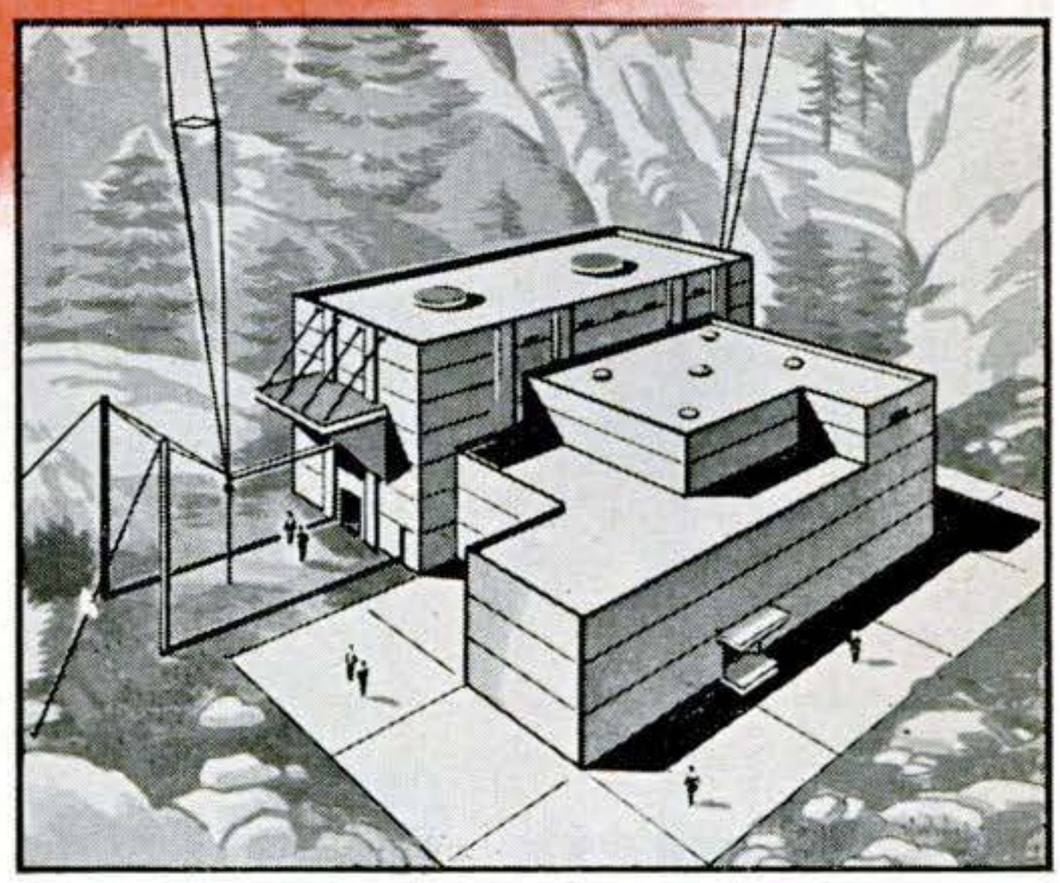



# Navy Builds Biggest Transmitter



**Transmitter building** for Navy's giant radio station will look like this. Equipped with complicated grounding system for electrical safety, it will take 15 to 18 months to build.

USING 2,000-foot mountains for antenna towers, the Navy is building the world's most powerful radio station. The new station at Jim Creek, Wash., will develop more than 1,000,000 watts. When finished, it will spray the voice of the Navy over the entire Pacific Ocean area.

The antennas will be suspended from a series of 200-foot towers, erected at intervals along the tops of two parallel mountain ridges. Use of the ridges eliminates building costly high towers.

The antennas will vary in length from 5,640 feet to 8,700 feet—roughly a mile to a mile and a half. From the midpoint of each span a 900-foot down-lead will be suspended. These will be connected to horizontal bus feeders. An arrangement of counterweight structures will keep the down-leads as nearly vertical as possible. The mountain-top towers are designed to withstand high winds and the accumulation of ice on the antenna spans.

The transmitter building, largest single structure of the installation, posed a tough design problem because of the vast amount of radio energy that will be developed. It will be built of reinforced concrete, with an elaborate grounding system, including copper shielding and a ground screen.

Access roads will be built to the transmitter building and the antenna towers, and 12 miles of power-transmission lines must be strung. Because of the installation's remote location, quarters, shops, and storehouses must all be provided. END



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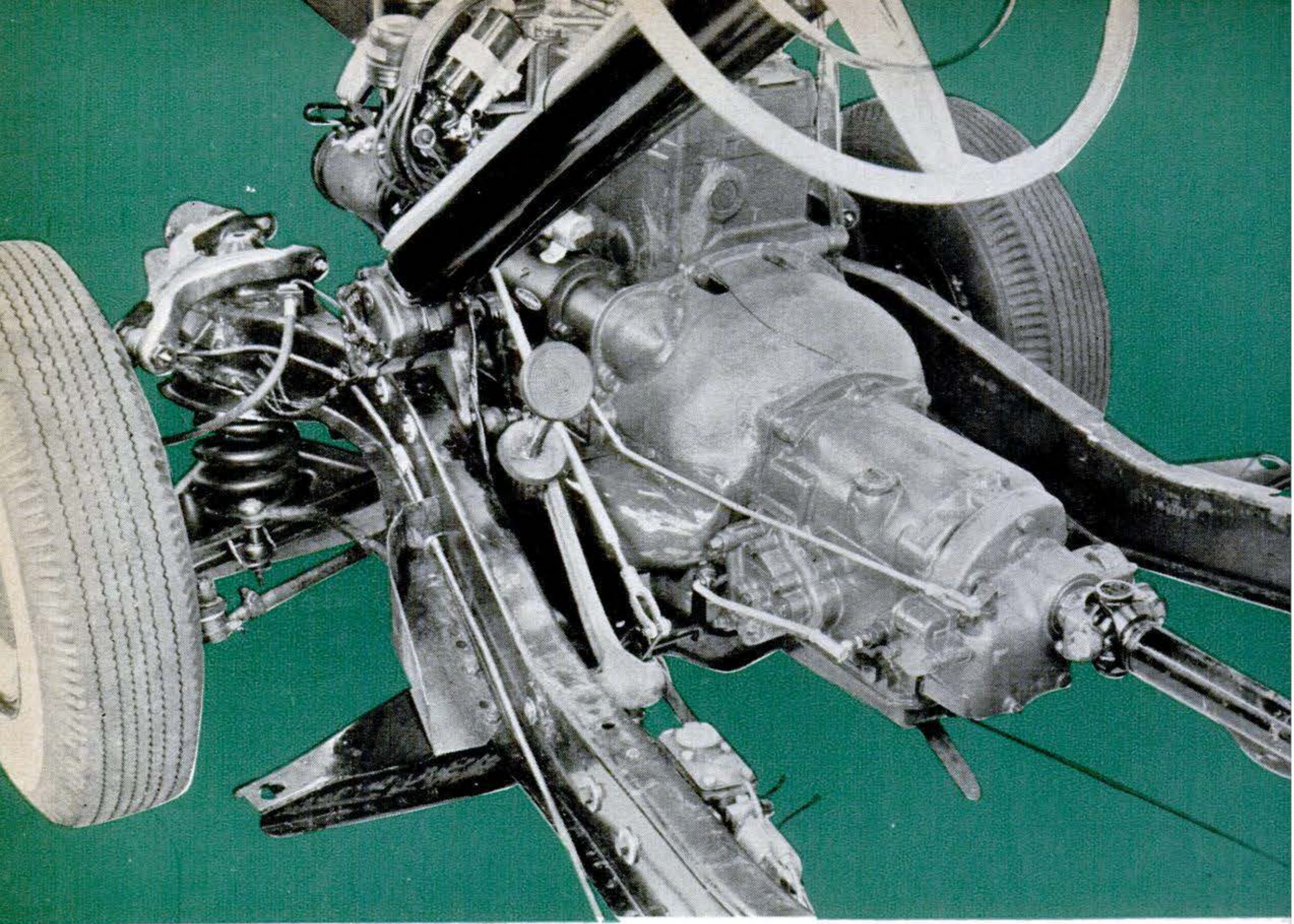

**Compact Studebaker/Borg-Warner drive** weighs 220 lbs., only 31 lbs. more than standard transmission. It is actually shorter than Commander overdrive transmission and bell housing.

# Studie Shows New Automatic Transmission

**No-creep stops, torque-converter starts, and direct-drive cruising mark this compact new drive.**

WITHIN a year after the war, Studebaker shocked and delighted the public with radical automobile styling. At the same time it went to work with the Detroit Gear Division of the Borg-Warner Corp. on an automatic transmission. It will announce the results—a drive that in some respects outpaces all others (see p. 98)—this month.

The easiest way to describe the new Studebaker drive is to set down what the company demanded of an automatic transmission before it would accept one:

Elimination of the clutch pedal; performance and flexibility comparable with that of the Studebaker overdrive transmission; shifting at any throttle position; the use of fluid for starting; engine braking ability on grades equal to or better than second gear in a conventional transmission; no "creep" at stops; a mechanical parking brake; foot-throttle control of shifting between a second gear and high; lock-out of reverse gear while the car is in forward motion, and yet the incorporation of a "rocking" feature for getting out of snow or mud; a transmission-cooling system independent of the engine-



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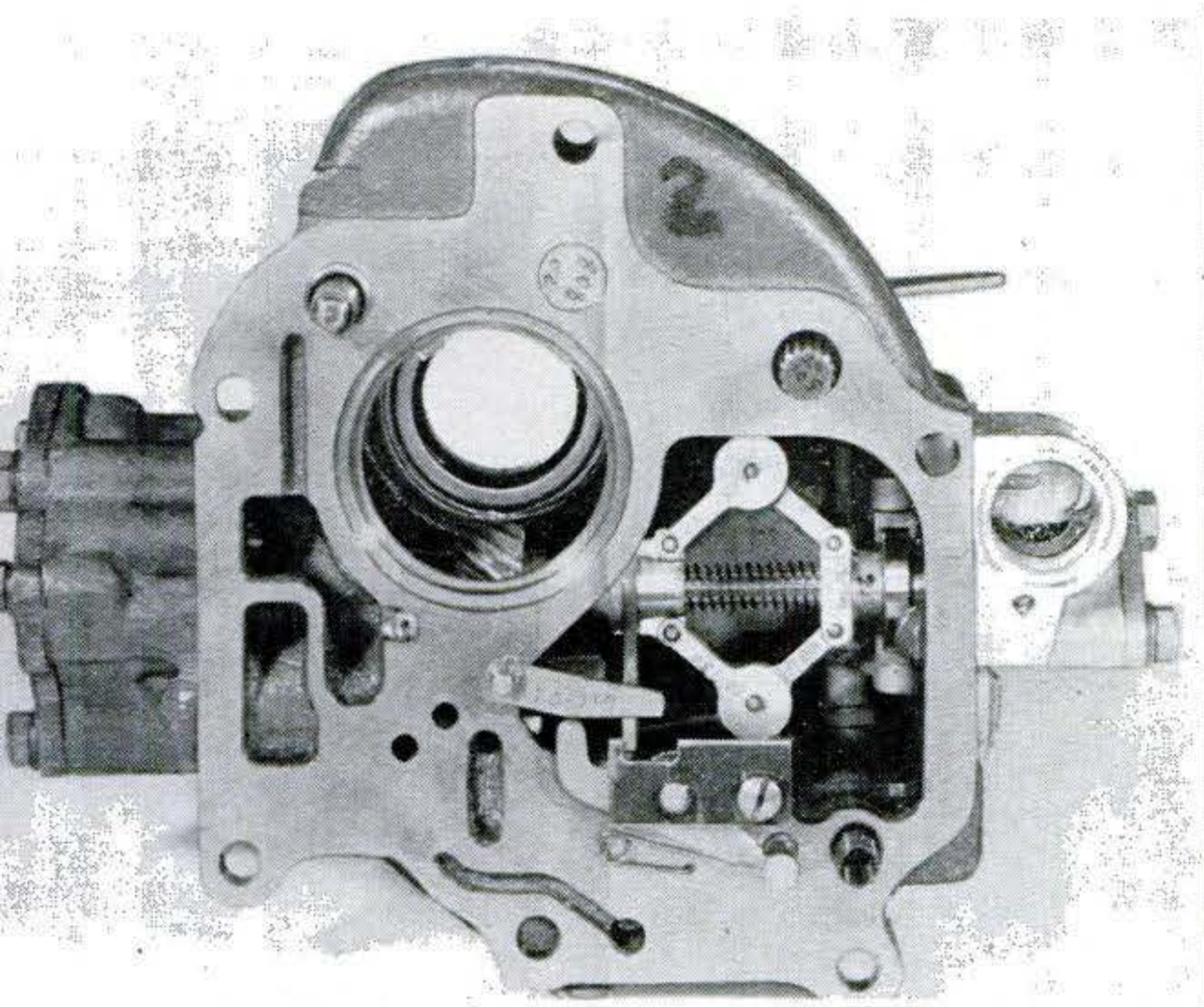
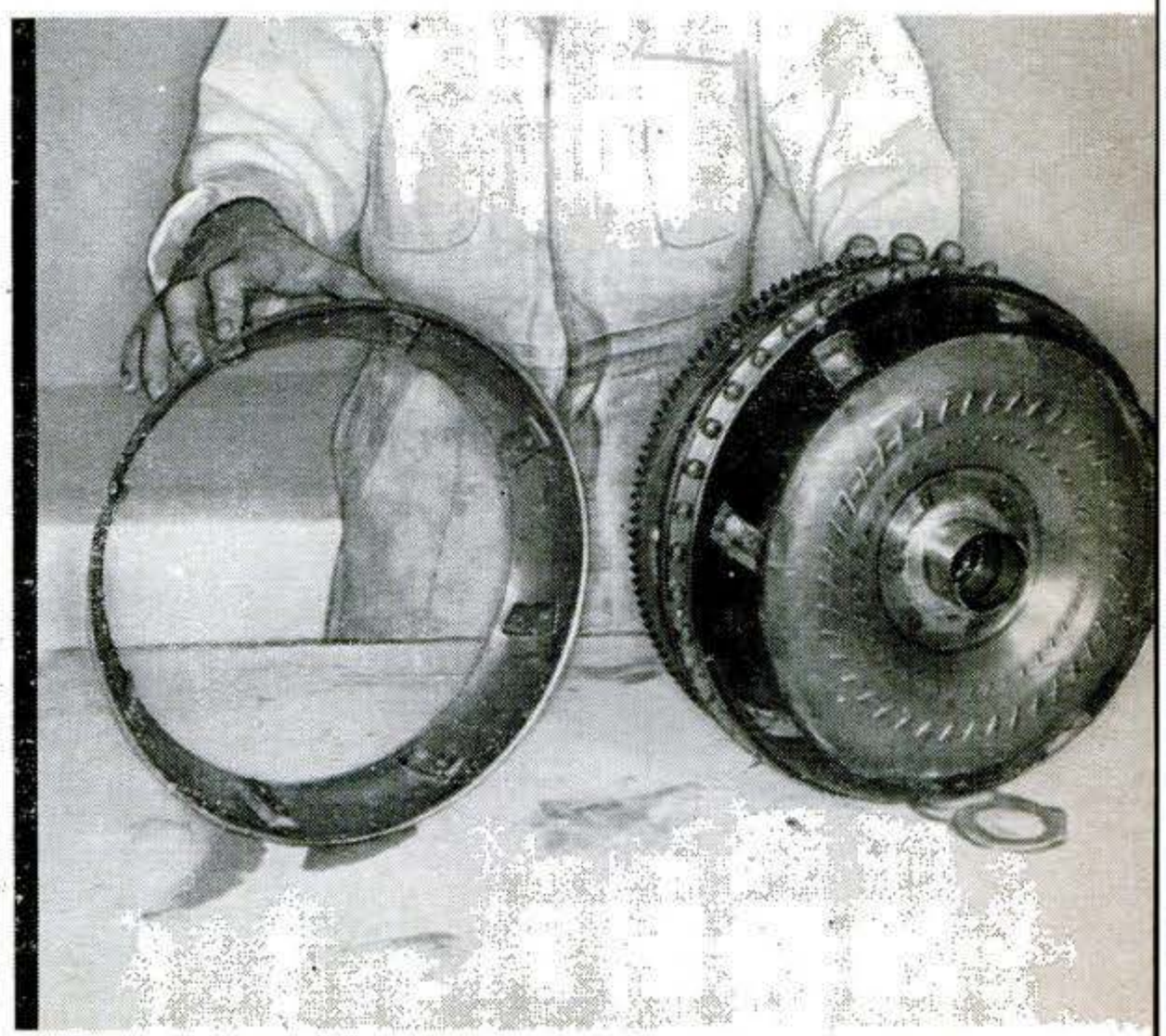
cooling system; shifting into low range (low gear plus converter) at speeds below 40 m.p.h.; retention of the characteristics of the Studebaker hill-holder; adaptability to the standard engine; dead-battery push starts at relatively low speeds, and starter cranking only if the selector is in Neutral or Park.

The Studebaker Borg-Warner drive has most of the components of other automatic drives and adds some of its own. Unlike the Ford-Mercury Borg-Warner job (to be announced later this year) the Studebaker drive cuts the torque converter out of the power train at any speed from 18 to 58 m.p.h. that the motorist desires. (At low speeds the converter is always in the power train; above 58, it's always out of it.) The S/B-W drive is more like the independently designed Packard drive (PS, June '49, p. 139). It locks up for a 1-to-1-ratio, mechanical linkage at the pleasure of the motorist, as does the Packard. Slippage, a drawback of even the best fluid couplings, is eliminated for highway cruising.

It eliminates "creep" at the stoplight, one of the less attractive features of almost all automatic and semi-automatic transmissions, with a ridiculously simple gimmick. This is an electro-hydraulic interlock between the brake and accelerator pedals. It goes on when you take your foot off the accelerator and brake to full stop; and it releases in-



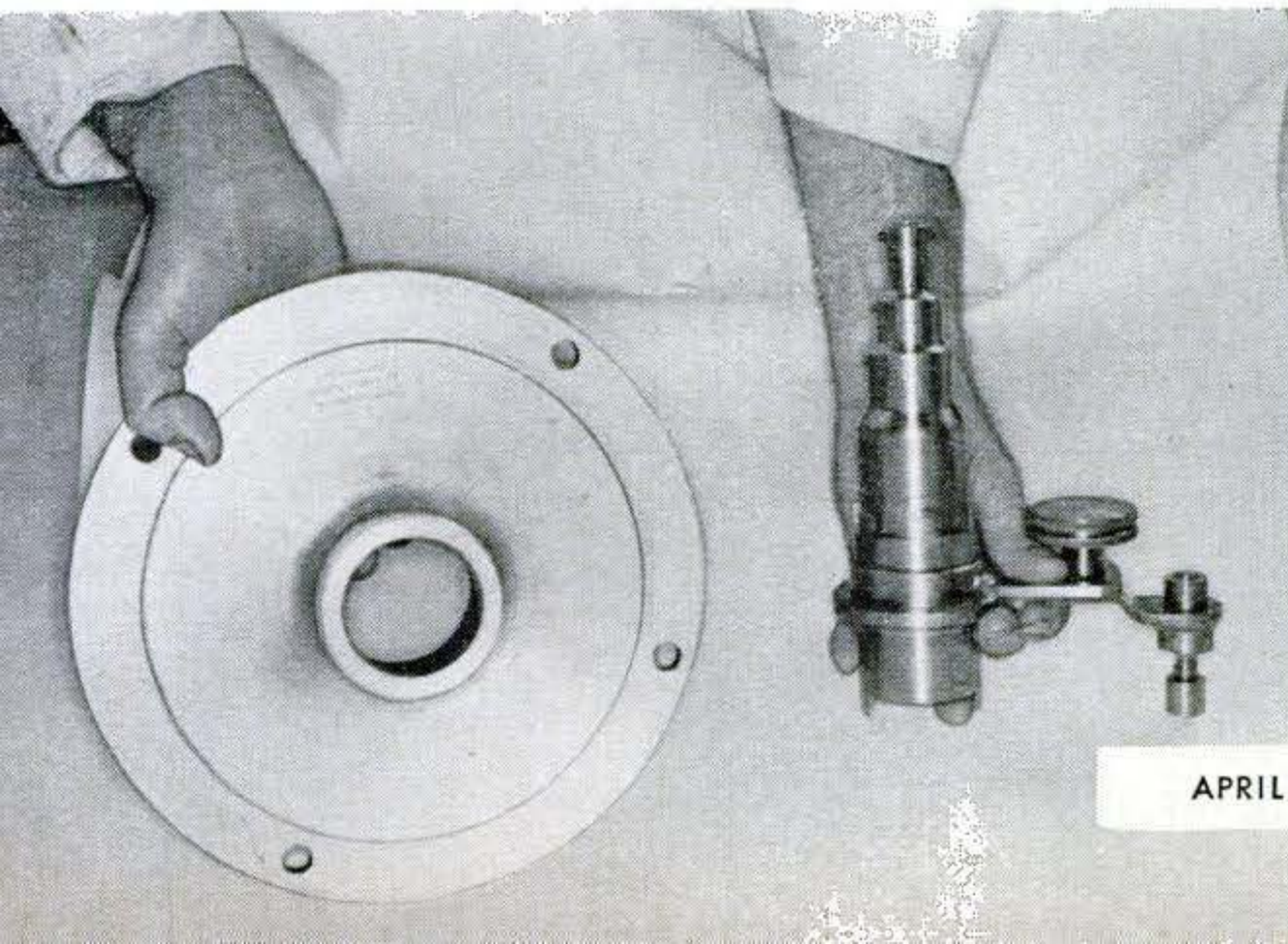
**Valve housing** contains numerous holes and ducts for pressurized oil that locks up torque converter and gears in "high." Note governor in right center. Transmission uses 11½ quarts of No. 10-W premium motor oil; consumption is low.

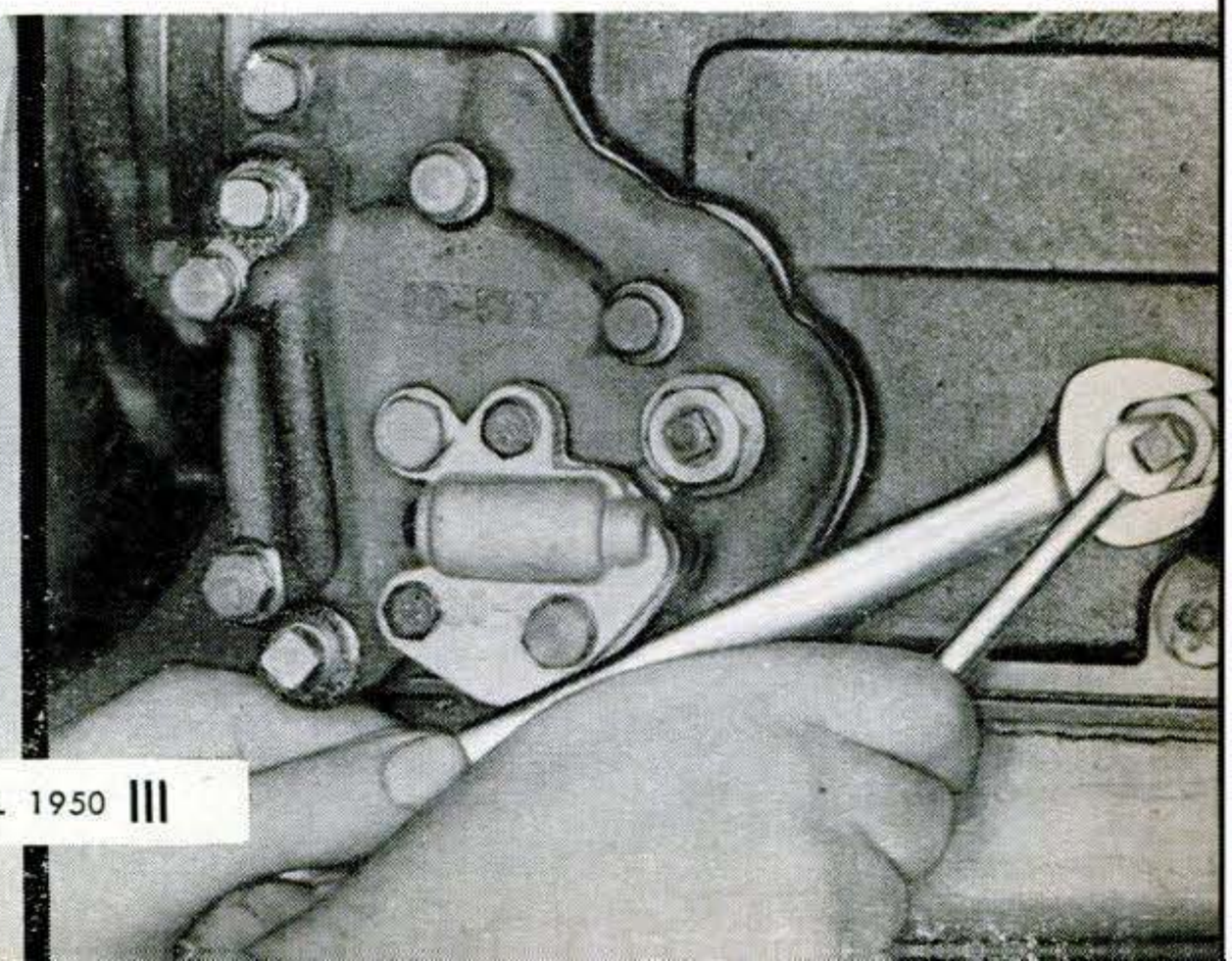


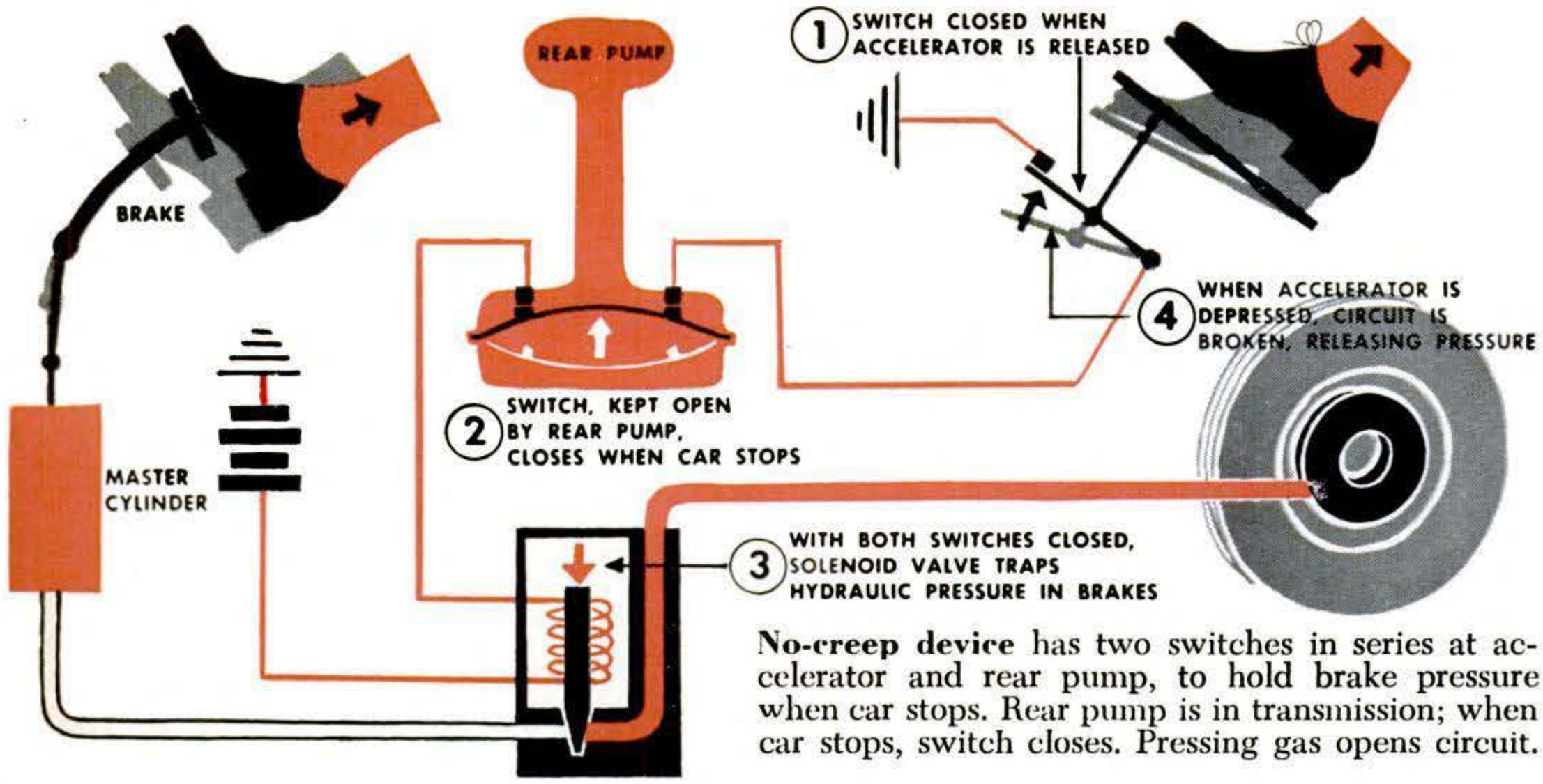
**"Sirocco" type of fan,** shown here installed on torque converter with a spare in mechanic's hand, keeps oil cool. Car has pulled 4,500-lb. trailer load in low range at full throttle up 6-percent grade for six miles without overheating.

**Servicing transmission** requires only two special tools—one for aligning splines (right below) and one to align converter. Transmission's pumping and cooling requirements are estimated at only 1 hp. at speeds above 50 m.p.h.

**There are no internal adjustments** for transmission or control valves. Here forward band, used to hold ring gear in planetary set, is adjusted. Rear pump, band servo units, governor, valve block are serviced from ouside.








**No-creep device** has two switches in series at accelerator and rear pump, to hold brake pressure when car stops. Rear pump is in transmission; when car stops, switch closes. Pressing gas opens circuit.

stantly when you step on the gas again.

The S/B-W drive has a decided safety factor. There's ample engine drag when you crest a hill at speed. Clumsy or careless motorists can wander all over the selector quadrant at any speed without doing any damage.

Beyond that, the company claims ease of servicing (a mechanic pulled one apart for me in less than an hour), a gas mileage about equal to that obtained with its standard transmission, an oil-cooling system that needs no extra or outsize radiator, and a remarkable getaway at the light.

I can testify that the S/B-W drive will perform—I've driven it. The car zips off from a standing start like a startled cat. The transition from torque converter-gear drive to direct drive and back again is so smooth it isn't noticed. But like all the new transmissions, it takes practice to get the most out of it.—*Devon Francis.*

## What Autoist Can Do with Selector in "Drive"

One criticism often voiced against automatic transmissions is that they deprive the driver of choice. That this isn't true of the S/B-W drive is shown by the following description of what happens when the selector lever is in drive position. It's also eloquent proof that motorists must understand their transmissions to get the most out of them.

At the moment of starting, with the selector lever at "D," the power train is through the torque converter and intermediate gear. Starting torque ratio in the transmission (not counting the advantage of rear-axle ratio) is 3.08 to 1, or more than three turns of the engine crankshaft for every turn of the propeller shaft. Automatic shifts from intermediate gear to direct drive occur within the following limits, depending on speed, throttle position, and load:

1 Starting with a very light accelerator depression, the transmission shifts from intermediate to direct at about 18 m.p.h.

2 Starting with full throttle (not depressed past the kick-down abutment on the floor-board), the transmission shifts into direct at about 35 m.p.h.

3 Starting with any accelerator depression between light and full throttle, the transmission shifts into direct between 18 and 35 m.p.h., depending on accelerator position.

4 Starting with full throttle and accelerator depressed past the kick-down point, the shift into direct occurs at about 58 m.p.h.

5 Coasting in direct with accelerator released, the transmission down-shifts into intermediate-gear-plus-converter at 12 m.p.h.

6 Direct drive may be over-ruled to provide the added torque available in intermediate by depressing the throttle to the kick-down point at any speed below 50 m.p.h.



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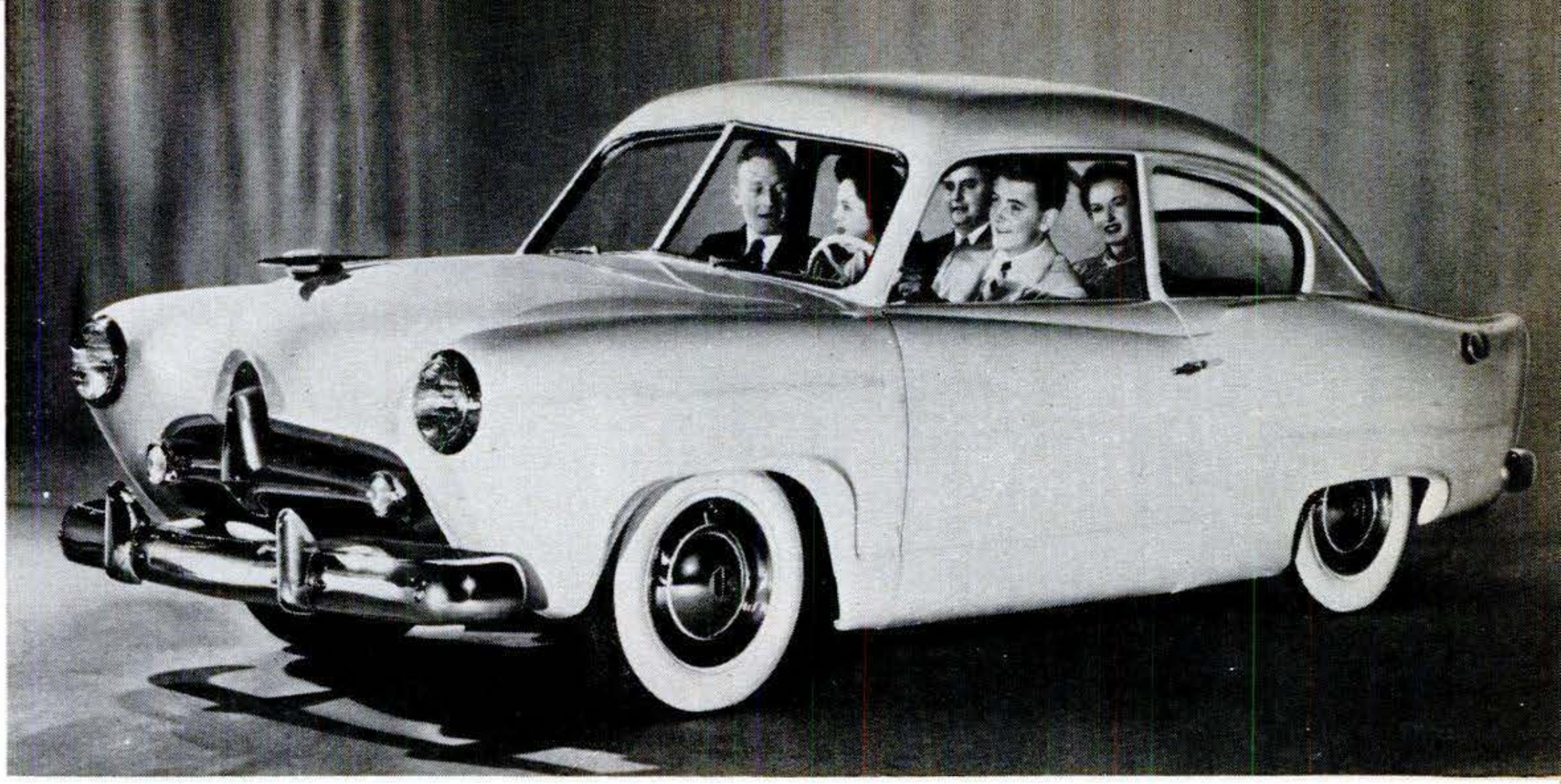
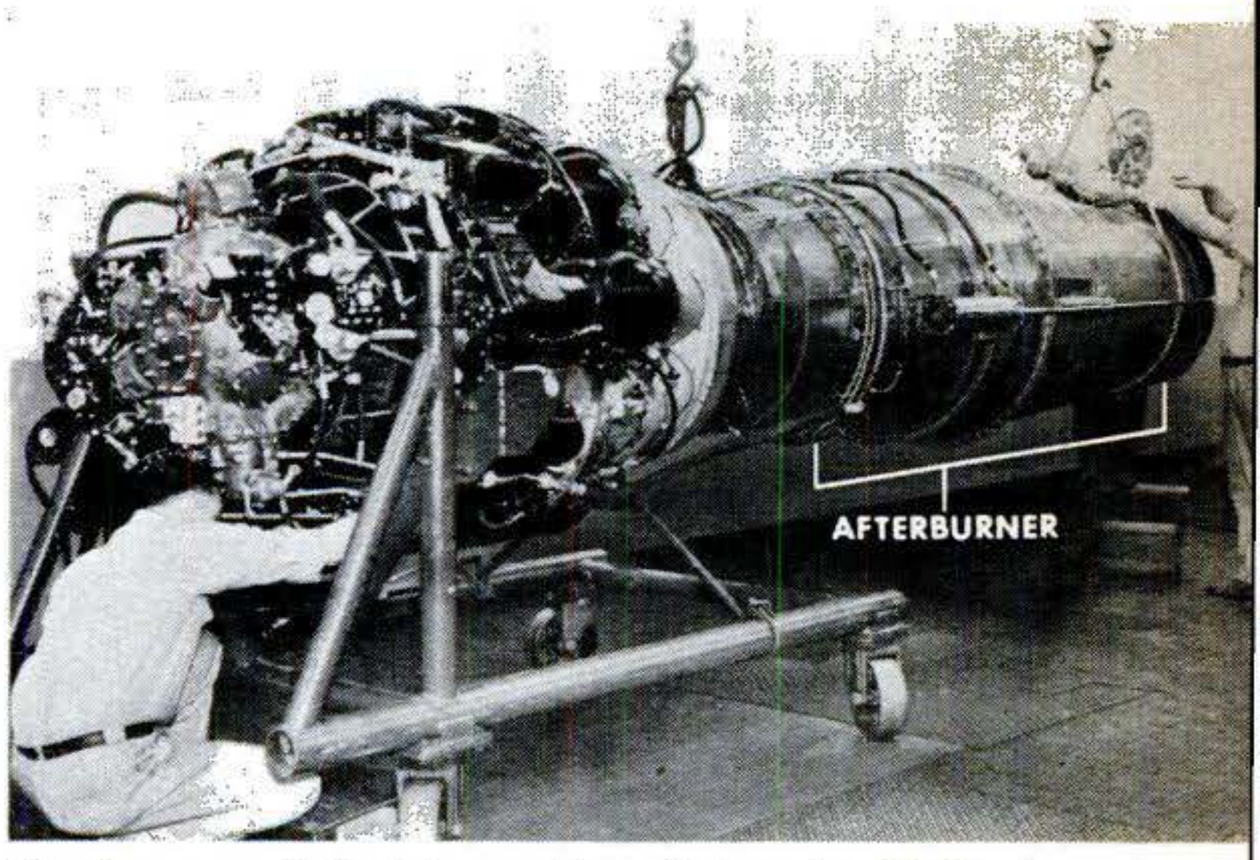


## Kaiser Shows Little Car

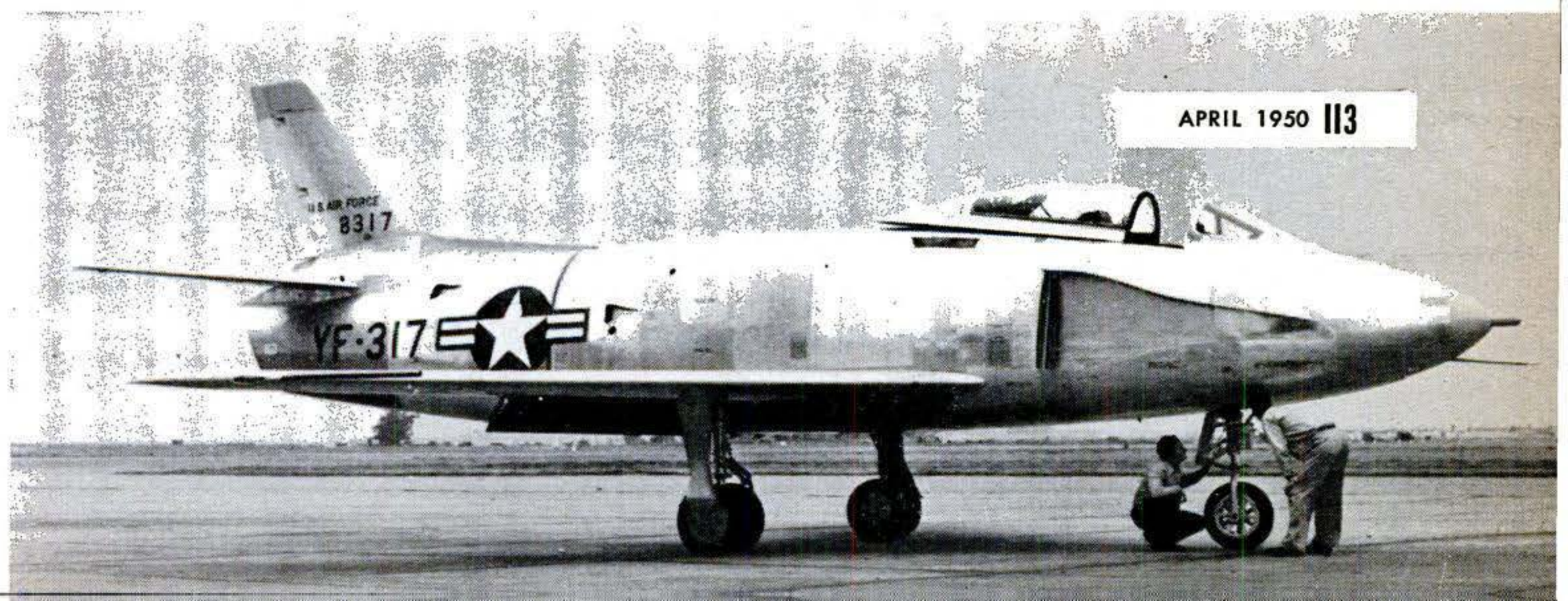
THIS little 5-passenger, 2-door sedan with a wheelbase of about 100 inches—priced to compete with Ford, Chevrolet, and Plymouth—will be produced by the Kaiser-Frazer Corp. beginning late in June. The company says the car will be "within the budgets of millions who have never been able to afford the purchase of a new automobile." With styling suggestive of Cadillac, Studebaker, and Buick, the new Kaiser will be available with either a 4- or 6-cylinder engine, giving from 30 to 35 miles a gallon. Other features are safety glass throughout, a low hood giving the driver an unobstructed view of the road, and a rear-seat folding arrangement that allows plenty of luggage space.

## Fast Fighter Weighs 10 Tons

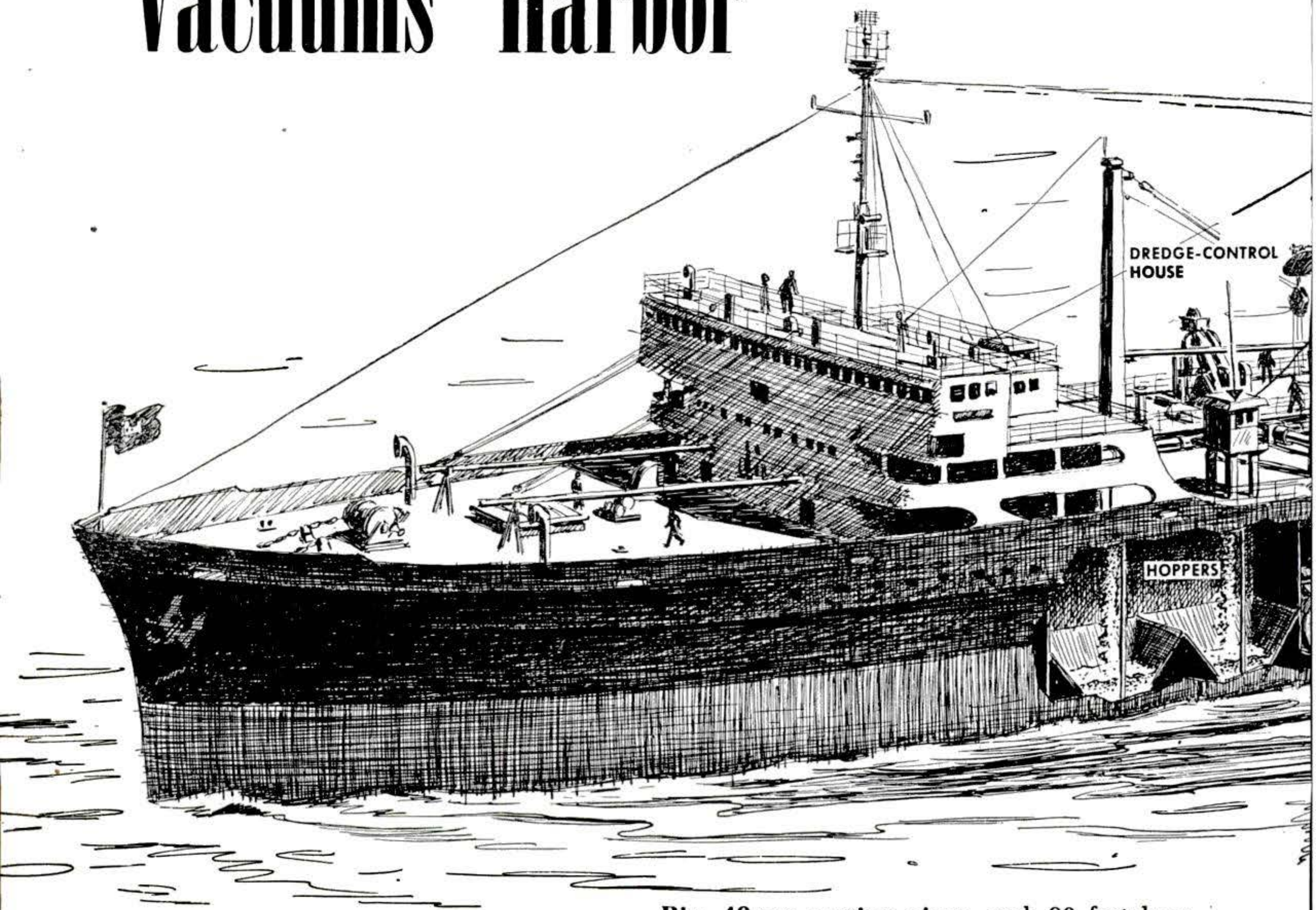
THE Air Force's newest jet penetration fighter, the North American YF-93A, weighs 10 tons, almost twice as much as its predecessor, the F-86. It is expected to beat that plane's speed record of 670 m.p.h. The YF-93 is powered by a new Pratt and Whitney J-48 engine developing 6,250 pounds of thrust, with another 1,750 pounds available through an afterburner. Flush air intakes on the sides of the fuselage leave the nose free to house radar. Because of its great weight, the new plane has five wheels for landing, one at the nose, and two twin-wheeled main gear that retract into the wings. With a wingspread of 39 feet, the plane is 44 ft. long and 16 ft. high.




**Most powerful jet engine** flying in U. S. is J-48 Turbo-Wasp. Redesigned from British Tay, it has huge afterburner as major U. S. contribution. Navy's new F9F-5 Panther also will have it.



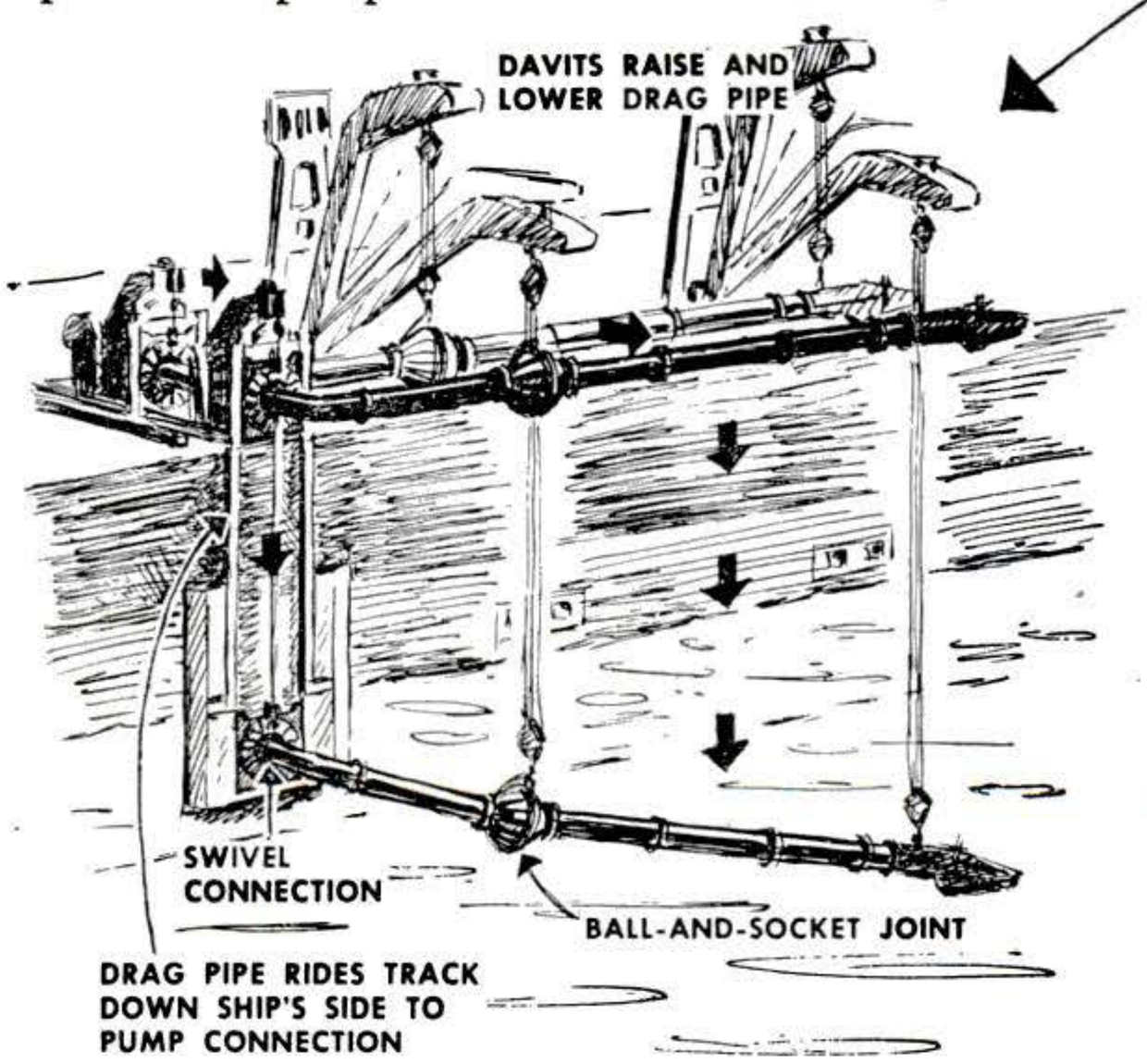
# World's Biggest Dredge "Vacuums" Harbor




**Big, 40-ton suction pipes,** each 90 feet long, ride tracks over edge of deck and then down ship's side to pump connection near waterline.

THE world's biggest dredge has been put to work clearing the silt out of one of the world's busiest harbors. The vessel, christened the *Essayons*, can tote more than 8,000 cubic yards of dredged material in her hoppers while maintaining proper channel depths in New York harbor.

The *Essayons* has two huge pumps driven by 1,800-hp. electric motors that suck up silt through two tubes like giant vacuum cleaners. The $11,000,000 ship was designed by the Philadelphia office of the Army Engineer Corps, and was built by the Sun Shipbuilding & Dry Dock Co., of Chester, Pa. With a length of 525 feet, she can accommodate a crew of 150 and can work on a continuous 7-day schedule.



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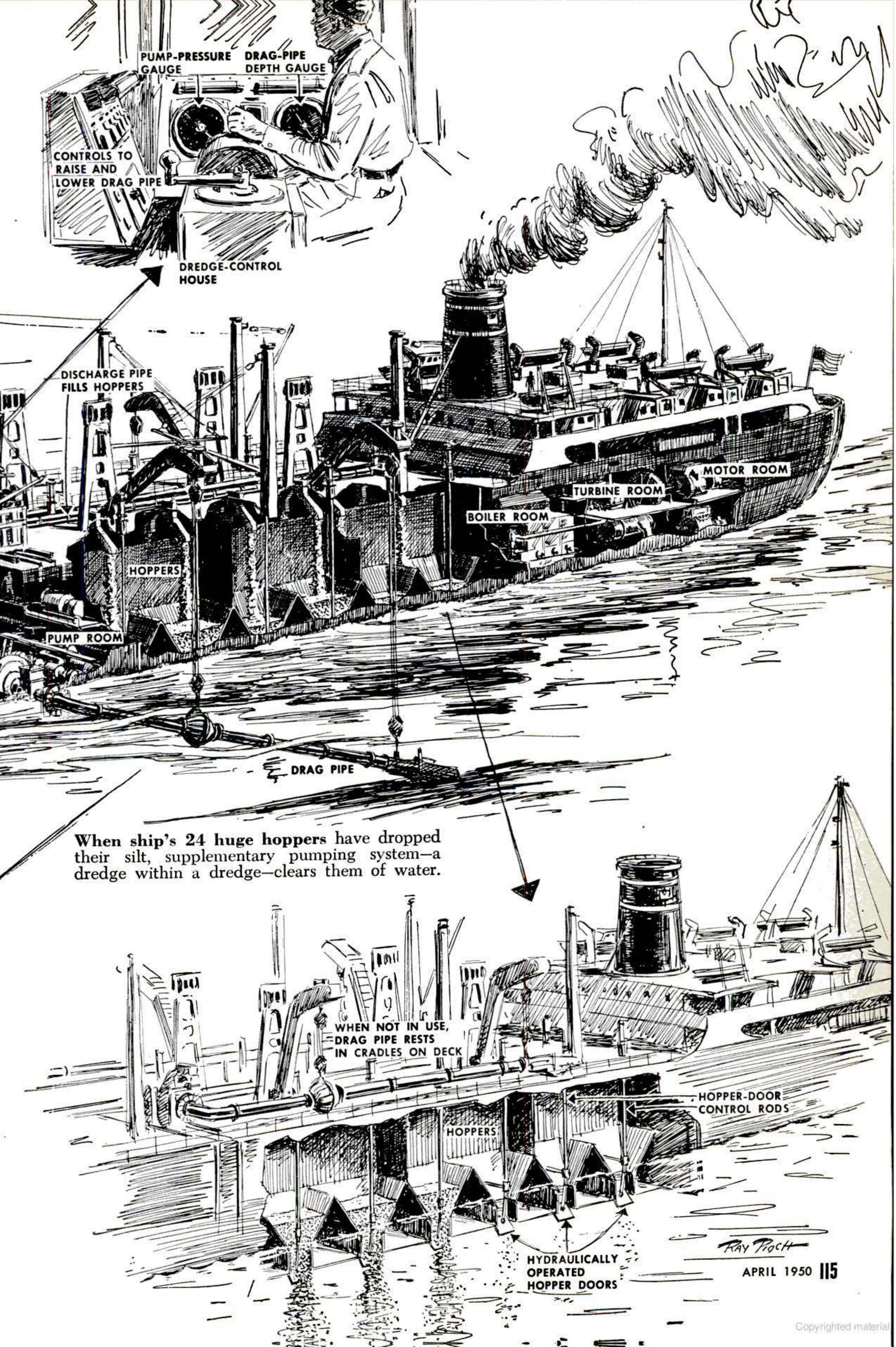


**When ship's 24 huge hoppers** have dropped their silt, supplementary pumping system—a dredge within a dredge—clears them of water.



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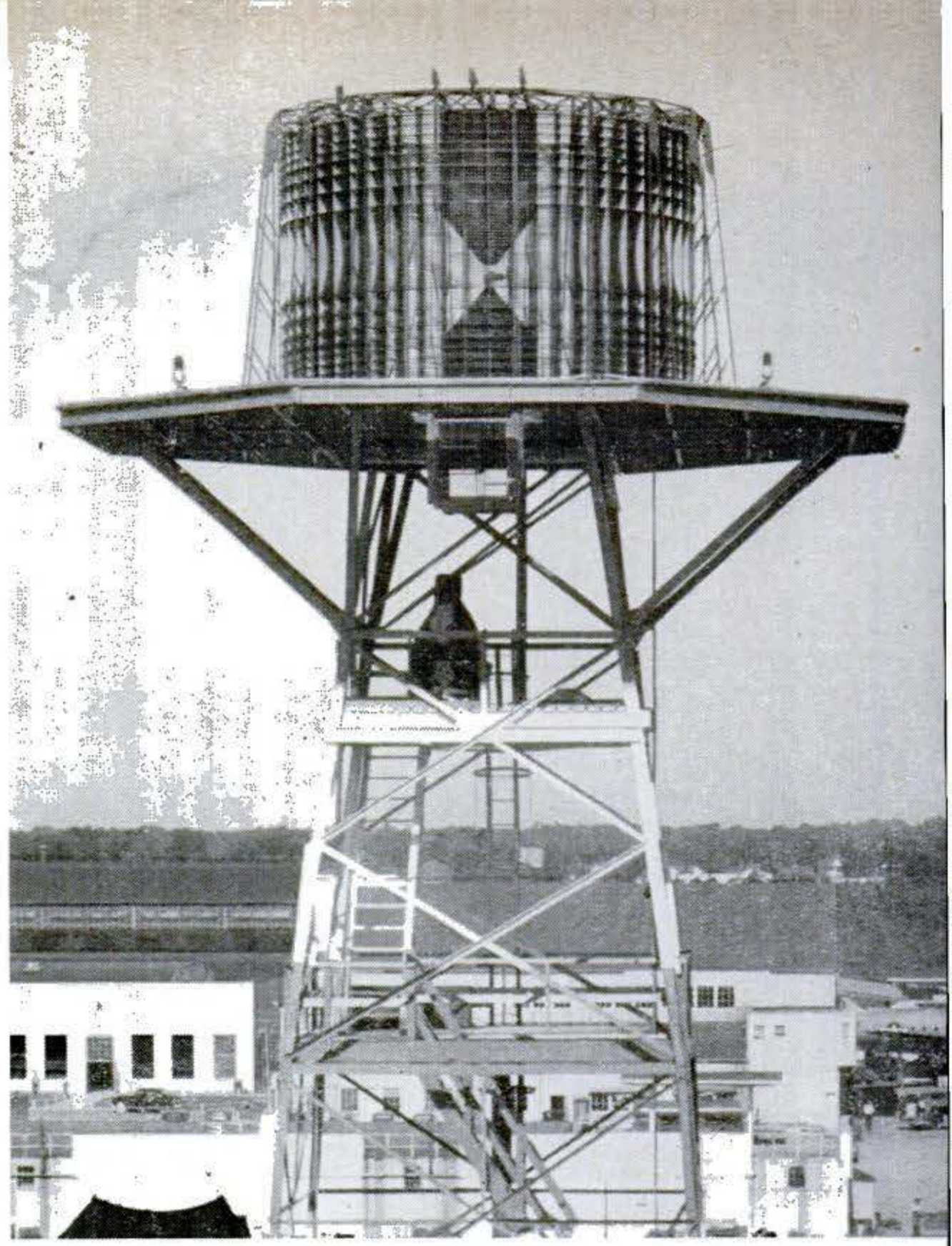
## Twin Tractors Wed Power

WHEN a job get too tough for the heaviest of caterpillar tractors, the Peterson Equipment Co., of San Leandro, Calif., teams two of them up in this side-by-side unit. It weighs 55,000 pounds and develops 270 drawbar horsepower. As shown above, the "wedding" is accomplished by removing the right-hand set of tracks from one tractor and the left-hand set from the other. The joined twins measure 13 feet, 4 inches across. Controls are also linked so that the mammoth can be manipulated from one cab.



## "Lighthouse" Antenna Improves Avigation Accuracy

THE radio antenna shown above mounted on a 75-foot tower resembles a lighthouse lens, with aluminum slats taking the place of glass. Its job is also similar; but instead of bending light waves, it directs radio microwaves toward the horizon, preventing ground reflection that would impair the accuracy of beams used to guide airplanes into an airport. Developed by the Speery Gyroscope Co. in conjunction with the Air Force, the new experimental antenna is part of a comprehensive program for handling air traffic more efficiently at commercial and military airports.

## Mower Trims Lawn Borders

THE tedious job of hand-cutting a neat edge along lawns bordered by curbs is eliminated by the new machine at left, powered by a gasoline motor. The rotary cutting head, shown in a vertical position in the photo, can be adjusted for trimming at a 45-degree angle or in a horizontal position. The latter position allows mowing around tree trunks and in many places otherwise inaccessible. The Modern Mfg. Co., of Pasadena, Calif., makes the lawn edger and trimmer.



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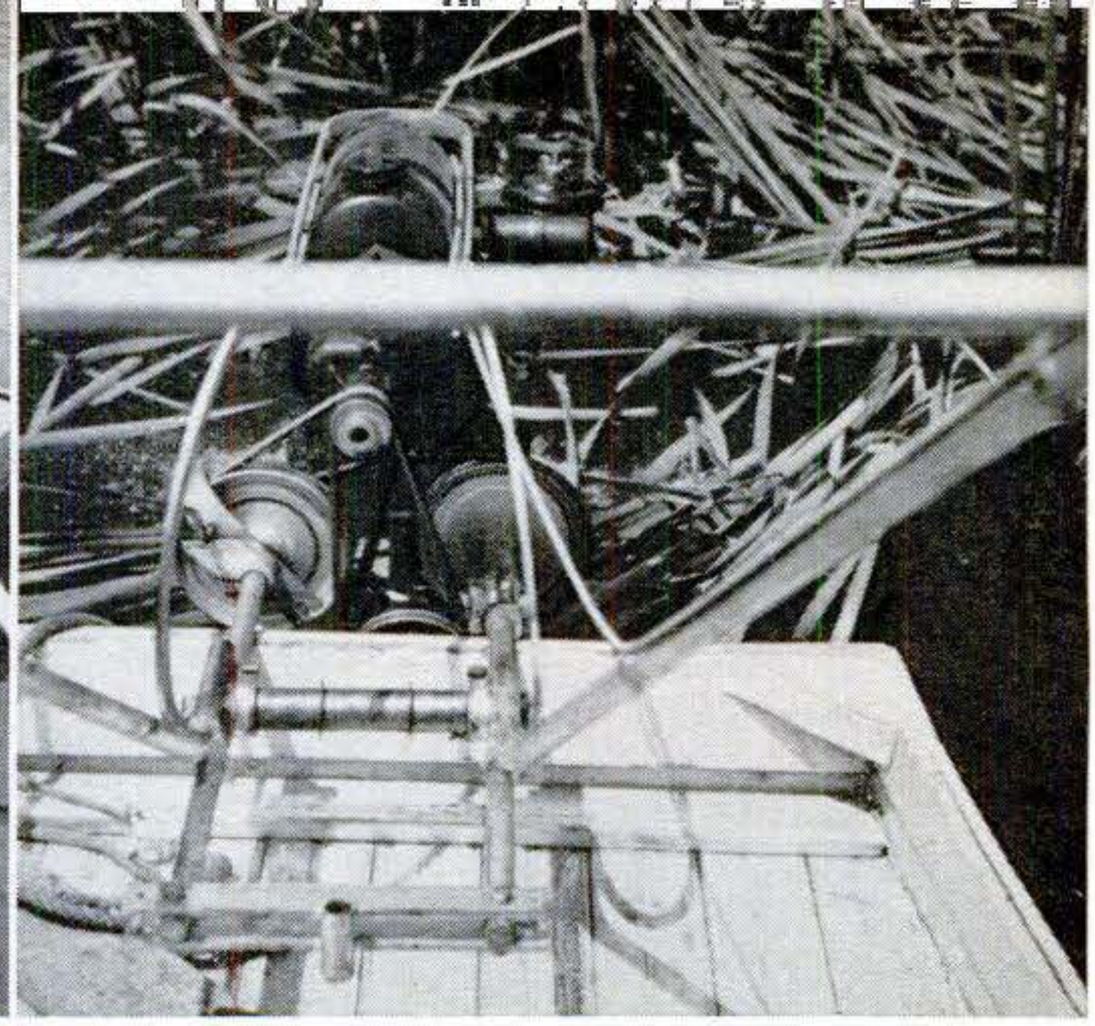
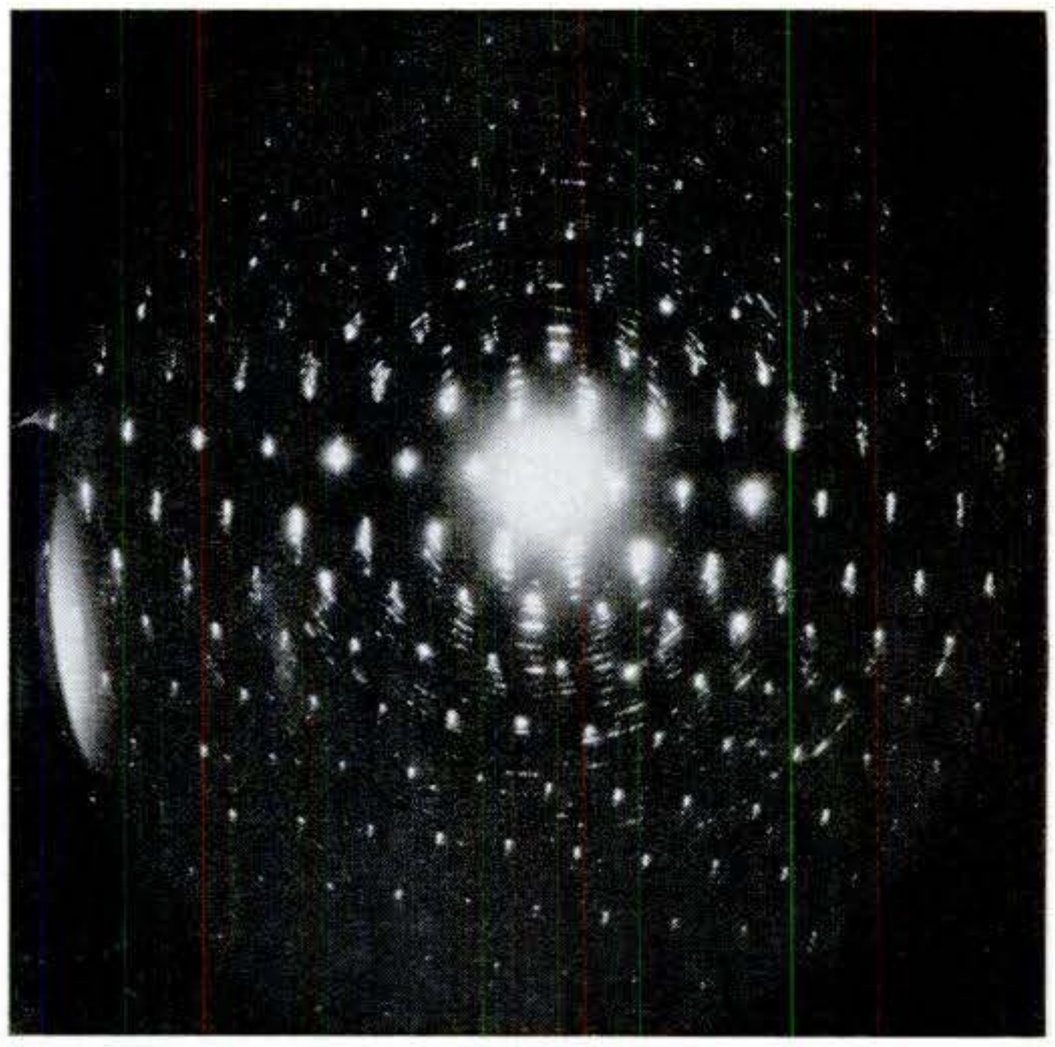


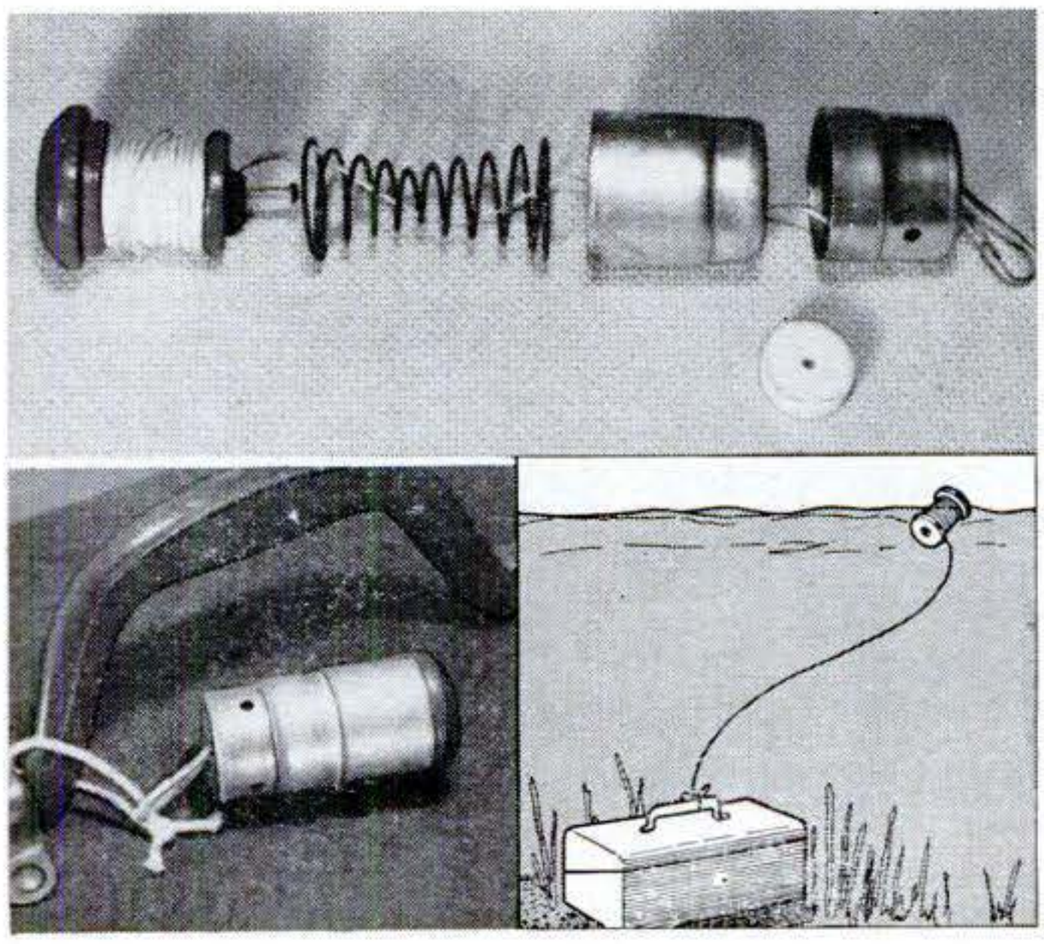
## Tractor Cuts Water Weeds

UNDESIRABLE growth in rivers and lakes get a quick mowing with a George Lawn and Garden Tractor mounted on the rear of a rowboat, like an outboard motor, as shown at left above. With the tractor wheel removed and a sickle bar attached, the machine is held in place by ropes tied to the handles and the oarlocks. As the boat is rowed backward, the sickle bar cuts a 24-inch swath through weeds (right). Community Industries Association, of Sullivan, Ill., makes the tractor, which sells for $97.50.

## Mica Makes Photo Pattern

THIS is a picture of mica—the shiny, flaky stuff used as electrical insulation. The reason it looks so unlike ordinary photographs of mica is that this one is a view made with an RCA Electron Diffraction Unit, of the internal structure of a mica crystal. When an electron beam is sent through a thin piece of mica, the atoms in the crystal diffract the electron beam, creating a pattern on a photographic plate. Physicists tell how the atoms in the crystal are arranged by studying the pattern. Since every material has its own characteristic diffraction pattern—like a fingerprint—the unit can be used for chemical analysis, revealing what's in a sample as small as 1/28,000,000th of an ounce.





## Bobber Marks the Spot

HERE'S a sure way of getting back your hunting or fishing gear if it should fall overboard. Hooked onto your gun, rod, or outboard motor, the aluminum cartridge shown at lower left contains a bobber, around which is wound 50 feet of nylon line, and a spring that is held in compressed position by a soluble tablet, seen at lower right in top photo. If your equipment falls into the water, the tablet dissolves, releasing the spring that shoots out the bobber. The bobber then rises to the surface, trailing its line. The Aqua-Triever®, made by the Milton Products Co., of Milwaukee, sells for $1.



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# Tom Thumb Air Force Performs on Tight Wire

A model Flying Fortress powered with four 3-hp. engines takes to air at Tom Thumb airport.

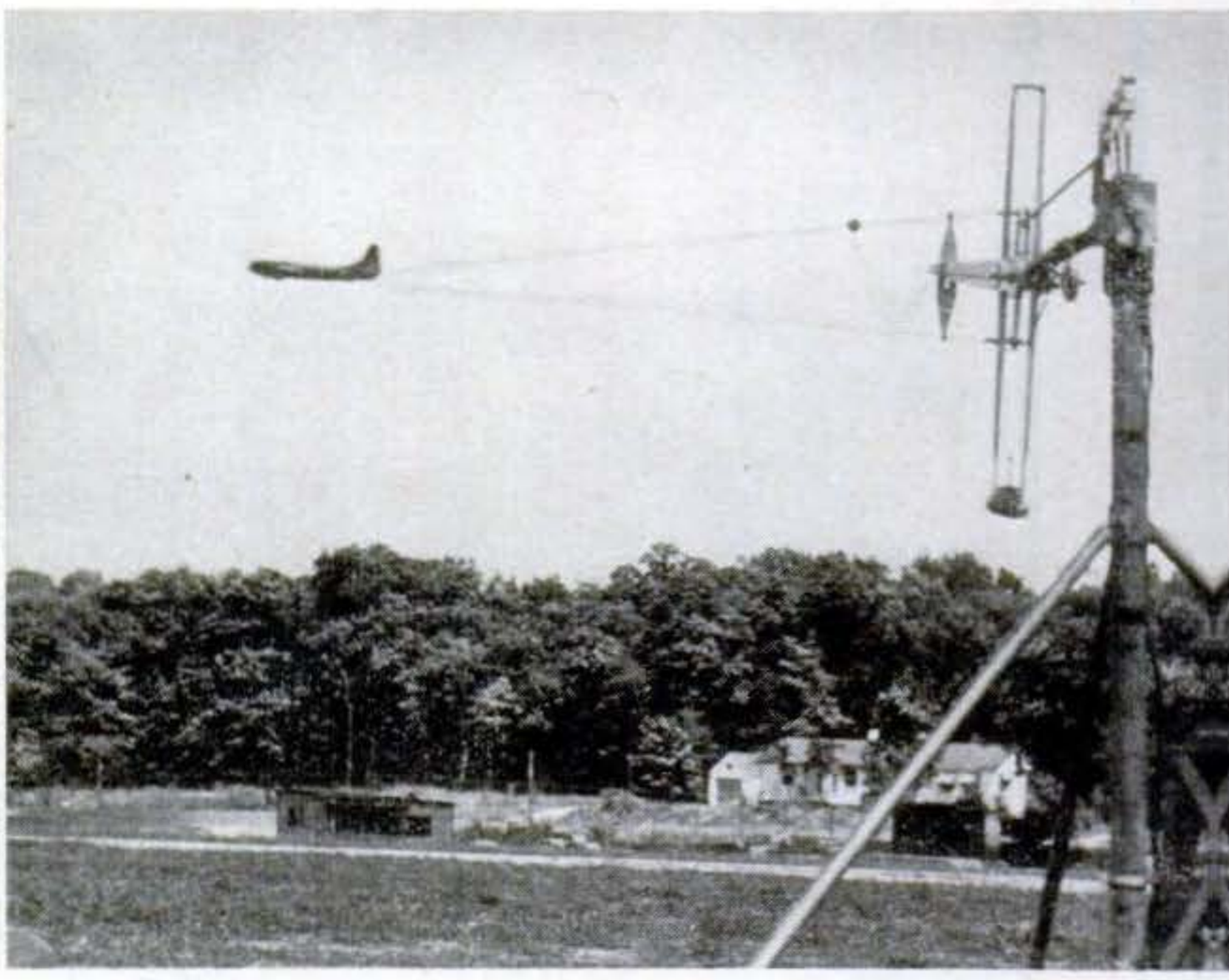
**A kids' sandlot hobby has grown into an important Air Force flight-testing technique that saves time, money—and lives.**

***By Jerome Lemelson***

A TOM THUMB air force based among the gently rolling hills of southwestern Ohio is supplying a lot of answers to why airplanes act the way they do.

The air force consists of real airplanes in miniature. They have real engines, real controls. Some are jets. Their speeds sometimes top 200 miles an hour. These baby speed demons are the latest additions to the government's model flight-research program.

**Workman aids launching** of a midget plane by guiding it during the initial stages of the take-off. Model is rolling on a 3-wheeled dolly that it sheds when it becomes airborne.



**Model in flight** can be seen beyond control pylon in foreground. Although limited to circular flight path around pylon, models supply wealth of data on problems of full-scale flight.



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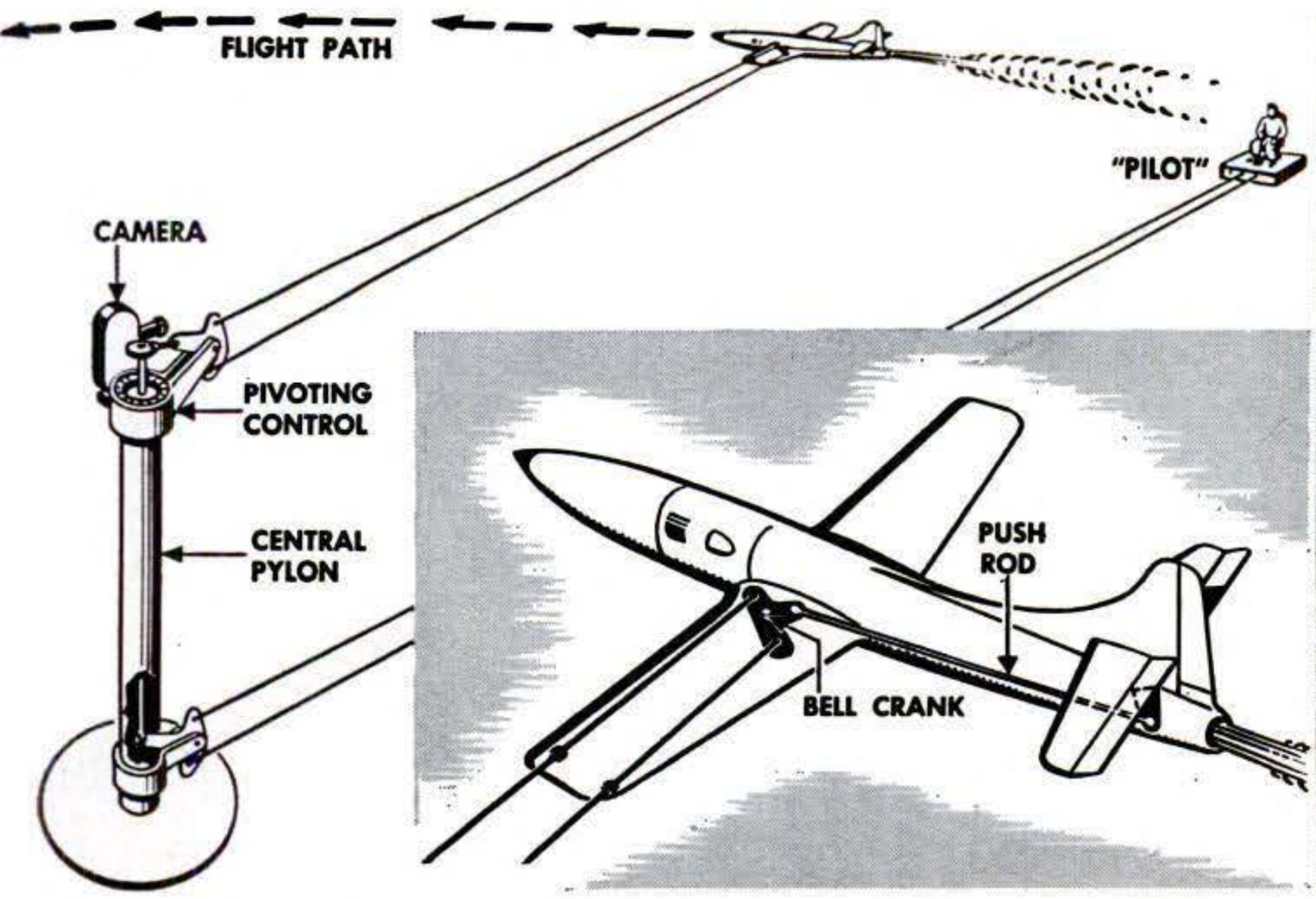
**On flight line, technicians of Air Materiel Command hold two types of jet aircraft under test.**

The Tom Thumb airport was set up by the Air Materiel Command's Aircraft Laboratory at the Wright-Patterson Air Force Base near Dayton, Ohio. Here an aeronautical engineer explains to a "test pilot" how the planes are flown.

"It's all done with wires," he says, as the pilot seats himself behind a control stick. "Your elevator and throttle control are at your finger tips, and you'll find that she responds in much the same manner as the big ships you fly. As soon as we warm up the engine you can take her off. When the engine cuts off, after the fuel runs out, glide her in for a landing."

Tethered by wires, the little planes are flown in a circle 400 feet in diameter—right alongside the world's largest runway, the 10,000-foot Wright-Patterson colossus. From these models the U. S. Air Force gets




**Two control wires** lead from "cockpit" (in photo at right) to a pivot at base of pylon. Linkage transmits wire movements to another pivot at top. Camera makes record of each flight.

**"Test pilot"** handles stick the same way it is moved in cockpit of full-size plane except that he cannot bank or turn. Designs hard to control get a "thumbs-down" at Tom Thumb airport.



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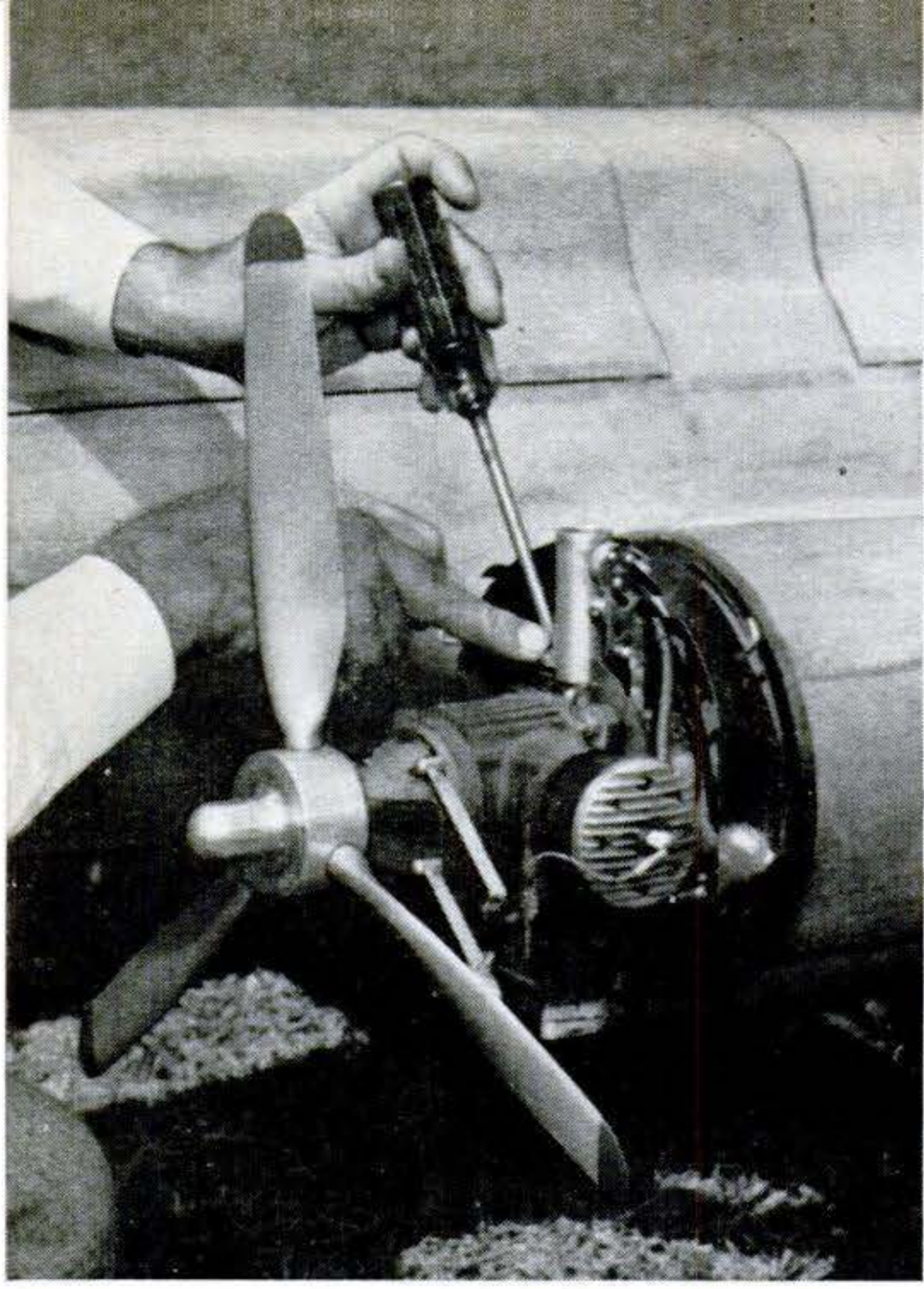

**An engine adjustment** is made in Flying Fortress before take-off. Throttle of tiny power plant is located in the vertical air-intake tube.

**Reciprocating engines** are started with flexible rotating shaft driven by electric motor; jets, by a Ford vibrator spark coil and plug.

vital information on the performance of proposed designs for real airplanes.

The midgets are designed and built by experts of the Aircraft Laboratory's Dynamic Model Unit. Flying experiences are shared with the "fly boys," test pilots for the AMC who frequently drop over to the test site to try their hand at aerial maneuvering in miniature.

### *$25,000 Is Cheap—for a Life*

Far from being toys, some models may cost as much as $25,000 to construct. This is a drop in the bucket, however, compared with the estimated millions of dollars that they will save by taking the place of costlier tests with full-scale aircraft. Of even greater importance is the saving in human lives that is expected from this research. Flying unmanned models often eliminates the need for a test pilot completely in certain risky preliminary flight tests.

Experiments at the tiny airport are conducted to examine flight characteristics of new airplane designs in diving and climbing attitudes or, in the technical phrase, to study flight movement about the pitching axis. The information obtained is used in conjunction with data from free-flight tests of radio-controlled models (PS, June '49, p. 120), which are also conducted by the unit. Combining both techniques gives a clearer picture of how the full-scale aircraft designs would perform if actually flown. The tests so far have proven the validity of this method.

In addition, air-to-air refueling operations have been investigated by flying two similar models, one behind the other, connected by a special rig. Information on the stability of the models and their effect upon the structure has already been obtained but is still confidential. The unit will soon seek information also on the flutter and vibration of new wing designs as the midgets whizz around the course at various speeds.

Founded early in 1945 by the Air Materiel Command, the Dynamic Model Unit has only recently expanded its program to include these control-line models, as they are popularly called. The first flight tests of the unit came about as the result of the crash at Wright Field of a glider—the XFG-1—in which the pilot was killed.

The glider had been first tested in miniature in wind tunnels, but this gave no indication of its tricky spinning characteristics. Unaware of these, the test pilot put the big plane into a spin from which he could not recover. It was then decided to build a flying model of the glider for pilotless-flight tests. The problem was presented to engineer Adam J. Stolzenberger, and the Dynamic Model Unit was born.



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**Tom Thumb fleet** also includes free-flying, radio-controlled gliders. Exposed view of this glider shows electronic devices and parachute pack to bring craft to ground without damage at end of flight. Data gleaned from flying it led Air Force to abandon this glider design in 1945.

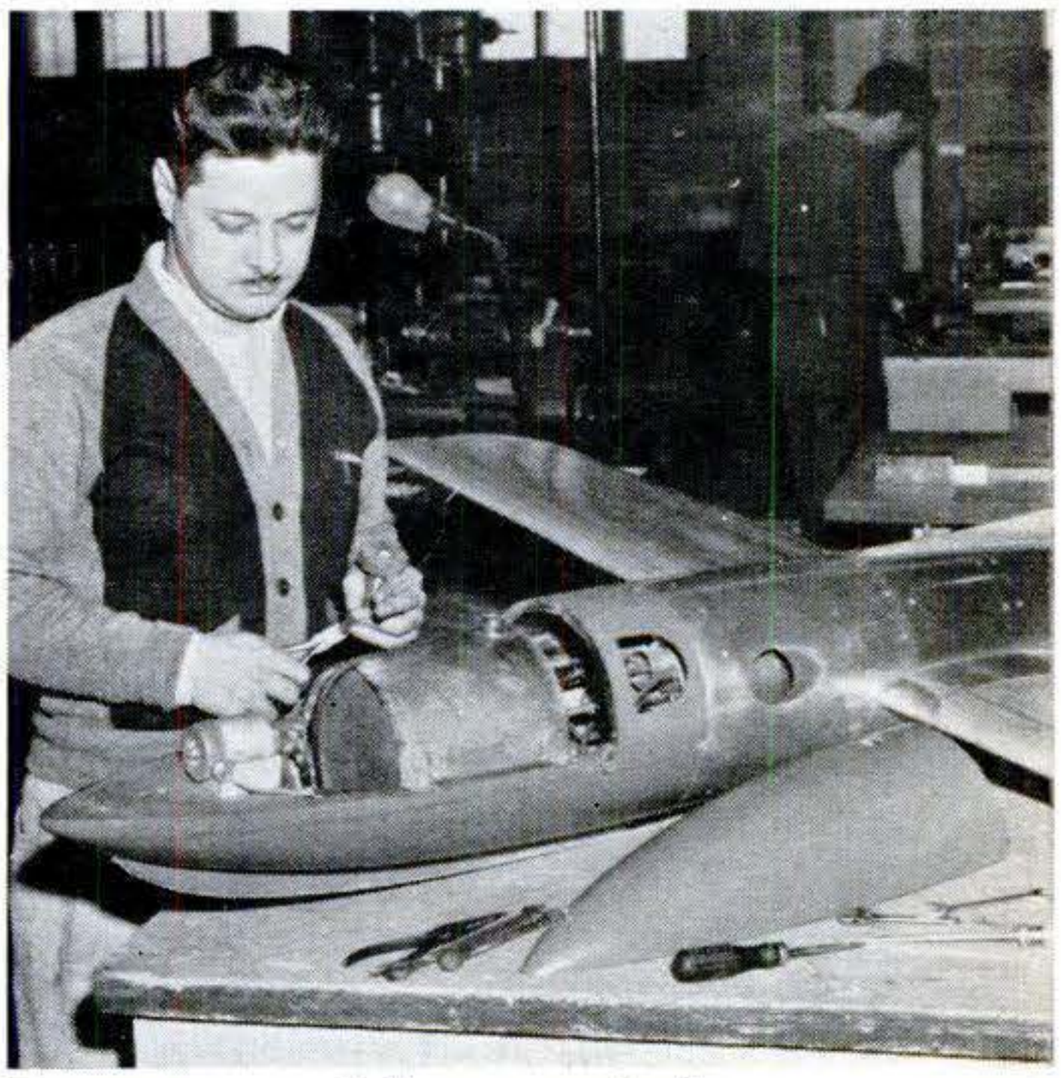
Stolzenberger, a wartime flight-test engineer, had been a pioneer in models and aeronautical research. He supervised the construction of a model of the XFG-1 with radio controls for the rudder and a parachute release to lower the model safely to the ground. Flight tests of this design showed that it was difficult to bring the glider out of a spin, and the design was abandoned by the Air Force.

Since then, the model unit has been built up into what is now a miniature air force—complete with jet fighters, bombers, model flying wings, and even helicopters. Some of the models are replicas of full-scale designs already in service, for the search for flight information is a continual process and not limited to proposed airplanes.

### *Midgets Fly Like Hobby Models*

The design and flying techniques employed by the members of the Dynamic Model Unit are similar in many respects to those practiced by hobby enthusiasts who fly control-line models for sport. The main difference, however, is that the pilot sits in a mock-up cockpit outside the flying circle where he can see everything going on. The hobbyist generally controls his model from the center of the flying circle.

Control of ground-to-air pitching (up and down) is attained at Wright Field ➧



**Removing cowl** from jet job shows power unit in fuselage. Engine is pulse type used in German V-1 buzz bombs. Compressed air, in addition to electric spark, is fed in to start it.

**Close-up of pulse-jet unit** shows fuel and air lines extending from head. Model spark plug is threaded into combustion chamber for starting. It is welded out of high-temperature steel.



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**Birthplace of the models** is this big workshop. For high-speed tests that might destroy expensive models, the unit now uses cheap, expendable plastic replicas like those in the foreground.

through two thin steel wires that extend from a control stick in the cockpit to a central pylon. These operate a mechanism in the pylon that controls two other wires out to the model. Moving the stick back and forth makes the elevators of the midget move up and down. Speed can be controlled by a third wire connected to the engine's throttle mechanism.

For safety, the control wires are tested to take a load more than double any expected at test speeds. A small, 25-pound model, for instance, will subject the wires to a pull of approximately 334 pounds when flying at 200 miles per hour on the end of a 200-foot line.

The smallest AMC design, a jet-powered experimental speedster, has a wingspread of four feet. The largest constructed to date is a scaled-down version of a new four-engine bomber with a 20-foot spread.

One of the first designs to be flown was used to check the accuracy of this type of model flight-research against the known results from a thoroughly tested airplane. This model, a scaled version of the famed B-17 Flying Fortress bomber, was powered by four geared gas engines turning over at a top speed of 7,000 r.p.m. Data obtained from the wire-guided flights of the B-17 checked closely with similar tests of the full-scale bomber. This proved the soundness of control-line research, and funds were allocated for further work.

Each midget is fabricated in the laboratory's shop by skilled craftsmen who adhere closely to exact specifications. A model's construction may take from weeks to months, depending on the complexity of the design. A good deal of the cost goes into making special equipment that is mounted within the model to measure and record flight-test results. Additional performance information is obtained from a movie camera mounted on the pylon and trained on the model as it is put through its maneuvers.

### *All This and Updrafts, Too*

Soon to be added to the test facilities is a unique air vent that will blow a gust of air up under a model as it flys over, simulating the violent air drafts sometimes experienced by man-carrying aircraft. The vent will have an exhaust area of 600 square feet and will run for a distance of 40 feet around the perimeter of the flying circle.

Manufacturing inexpensive models from plastic materials on an assembly-line basis for use in high-speed flight testing has been started. Some will be jet-propelled faster than sound over a free-flight experimental range that is planned for a western desert area. At such speeds, they must be considered expendable—hence the desire for mass production to lower costs.

The pioneer model-testing program at Wright-Patterson Air Force Base is one of several now being carried out by the government and industry. They are helping the development of tomorrow's aircraft by a technique that evolved from a hobby of the air-minded youth of America. END



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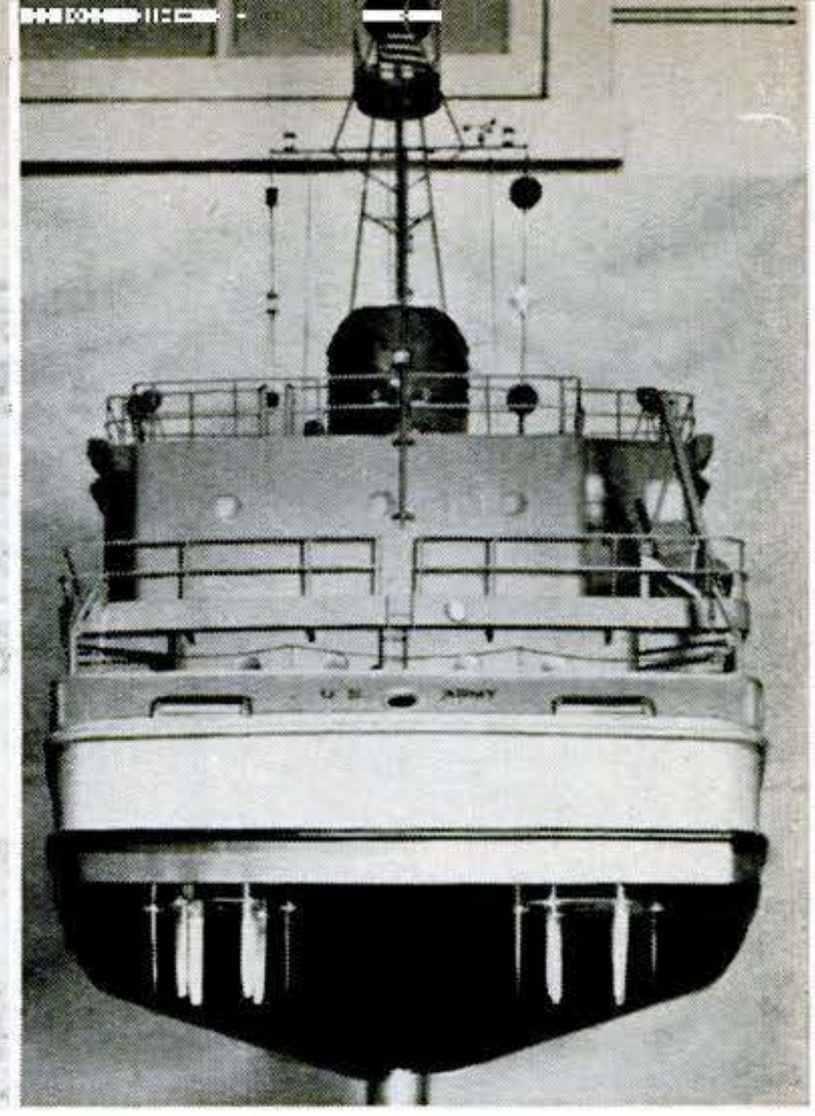

## Merry-Go-Round Propellers Steer Ship, Too

SHOWING off how she can reverse course within her own length, the mine planter *Sgt. Truman Olson* above is the first military craft designed to use cycloidal propulsion (PS Oct. '43, p. 66; June '46, p. 73). At the bottom of the model, at right above, are the twin propeller-rudder units. Each consists of a rotor disk driving six vertical blades. By changing the angle or pitch of the blades, the ship can perform a wide range of unorthodox maneuvers, such as moving sideways either to port or starboard and reversing herself instantly. No rudder is necessary—the propellers steer.

## Tape Traps Pilot-Tower Talk

THE magnetic-tape recorder at left can record conversations at airport control towers over 14 separate channels simultaneously. Since pilot-tower communications are mostly on two channels, 28 voices could be transcribed on a single tape less than three-quarters of an inch wide. The tape moves, as in a motion-picture projector, from a supply reel to a take-up reel, passing over a series of recording heads, one for each message or communications channel to be recorded. The second reel unit takes over automatically before the first is exhausted. The unit is manufactured by the Brush Development Co., of Cleveland.

## More Power for New Jeeps

SOUPED-UP engines and a sharpening of some body lines mark the new Willys-Overland jeeps shown this month. The station wagon (left) is available with either a 7.4-1 compression-ratio, four-cylinder "Hurricane" engine, or a 6.9-1 compression-ratio, six-cylinder "Lightning." The four-cylinder job—an F-head design—provides 14 percent more power and as much as 25 percent greater gas mileage, thanks to improved engine "breathing." Pointed shapes for grille and fenders are the main style changes.



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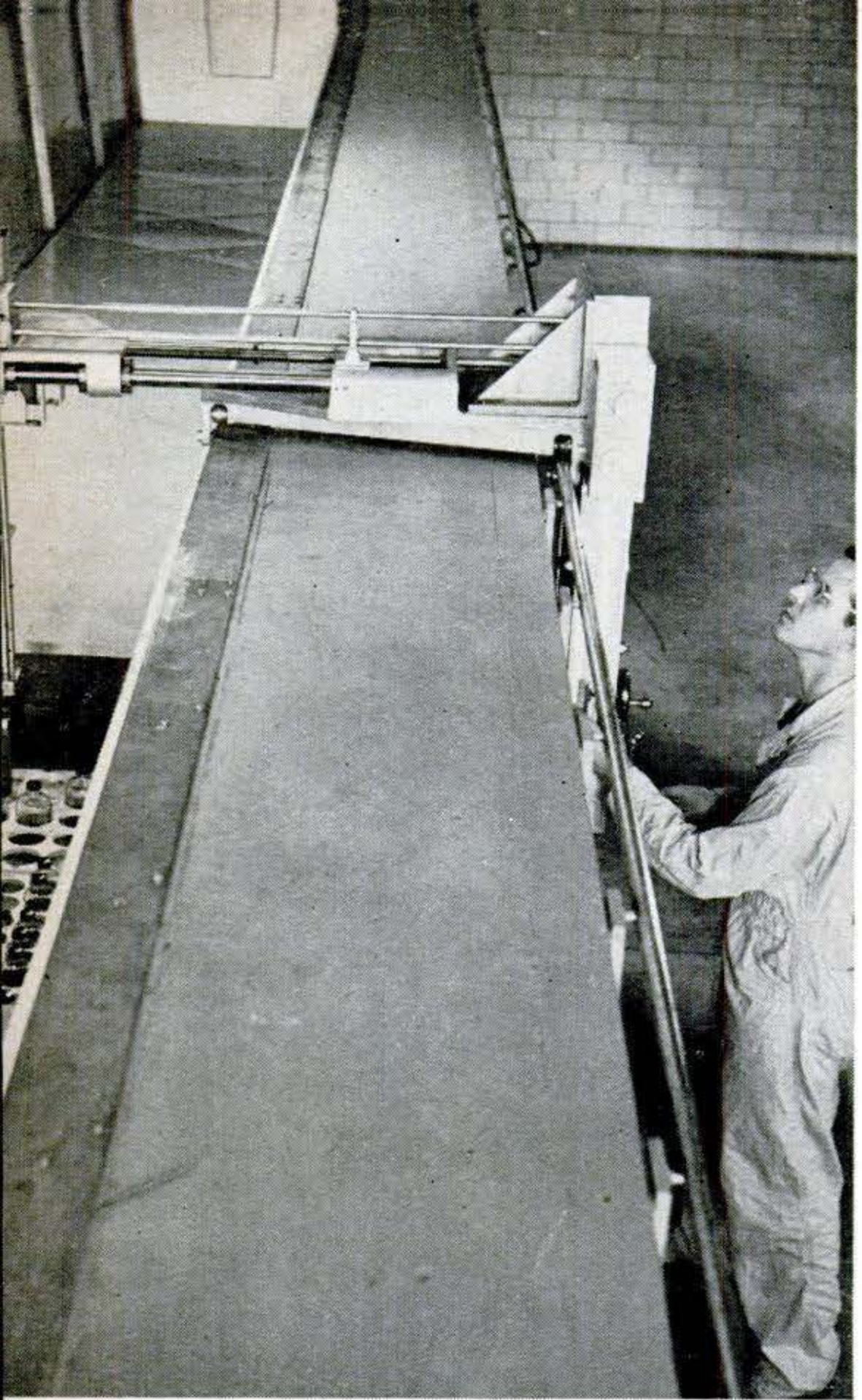


# 'Hot' Atoms Sold Here

**This strange store at Oak Ridge, Tenn., ships radioisotopes to scientists.**

***Photos by J. E. Westcott of AEC***

THESE photos were taken inside Uncle Sam's new isotope store at Oak Ridge, Tenn. It fills mail orders for perilous and perishable radioisotopes from hospitals, industries, and research laboratories.

Clerks in this store never look directly at the shelves. They stay on the safe side of lead and concrete shields, and fill orders with remotely controlled tongs. Most of the merchandise is kept and sold in liquid form.

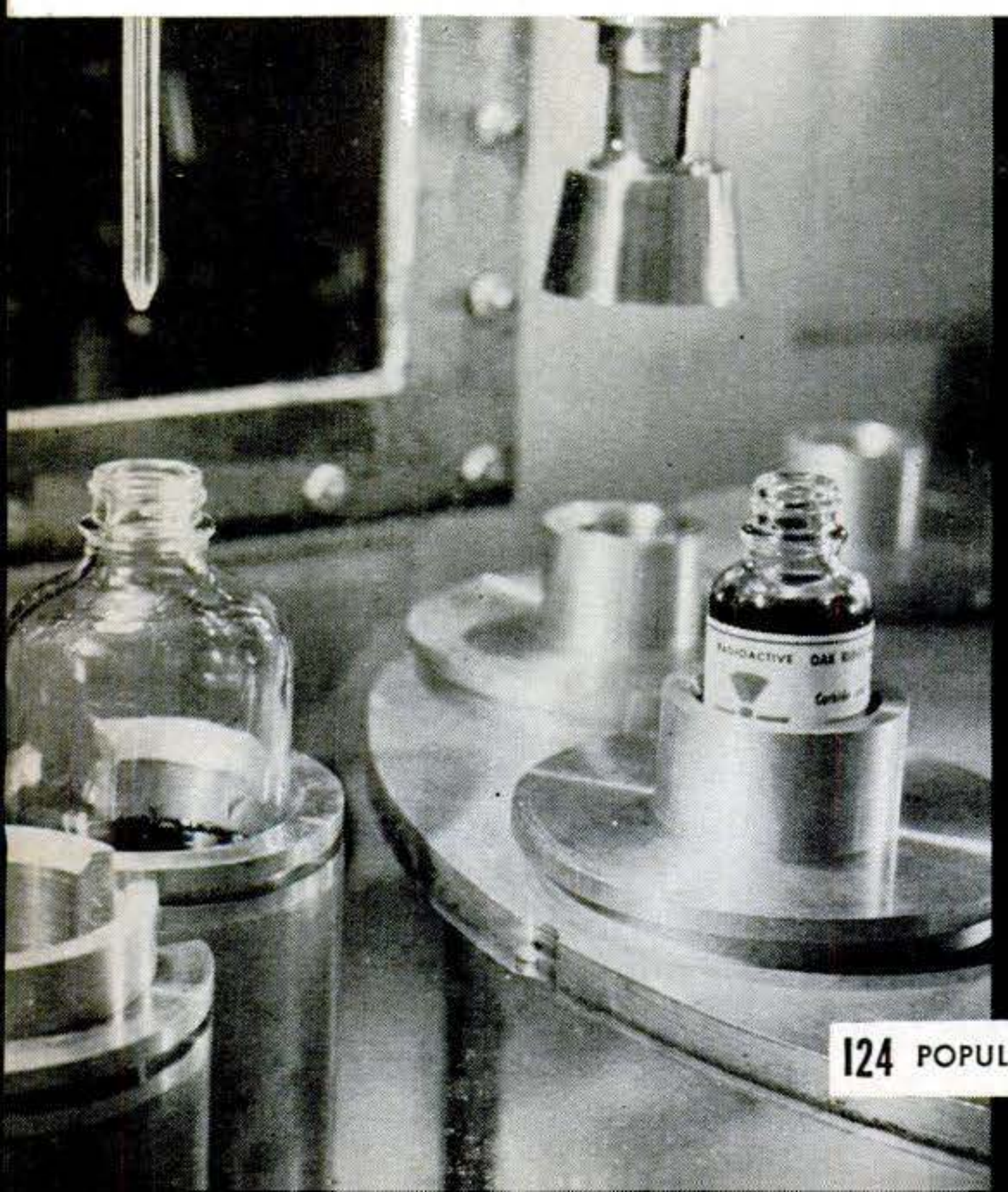
Last January, 630 shipments were made from this high-powered pharmacy. One twenty-fifth part of a dime would weigh as much as all of the radioactive atoms in those shipments. But the shielding in which they were packed for shipment weighed 17½ tons.

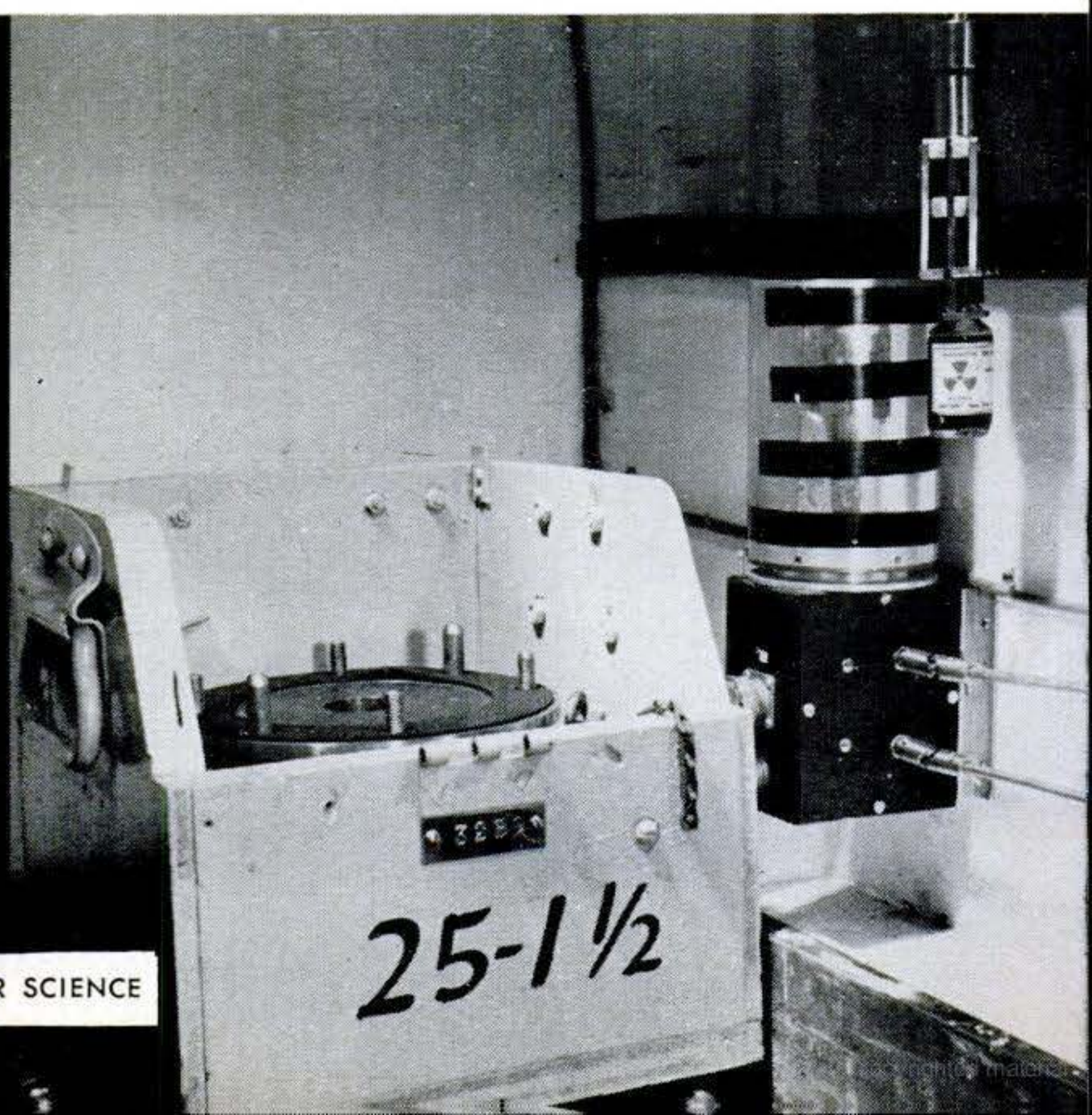
The equipment shown is housed in a building with walls two feet thick. This new part of the Oak Ridge laboratory cost $2,000,000. It was built because the demand for radioisotopes is increasing. They're used to combat illness, reduce manufacturing costs, and study nearly everything.

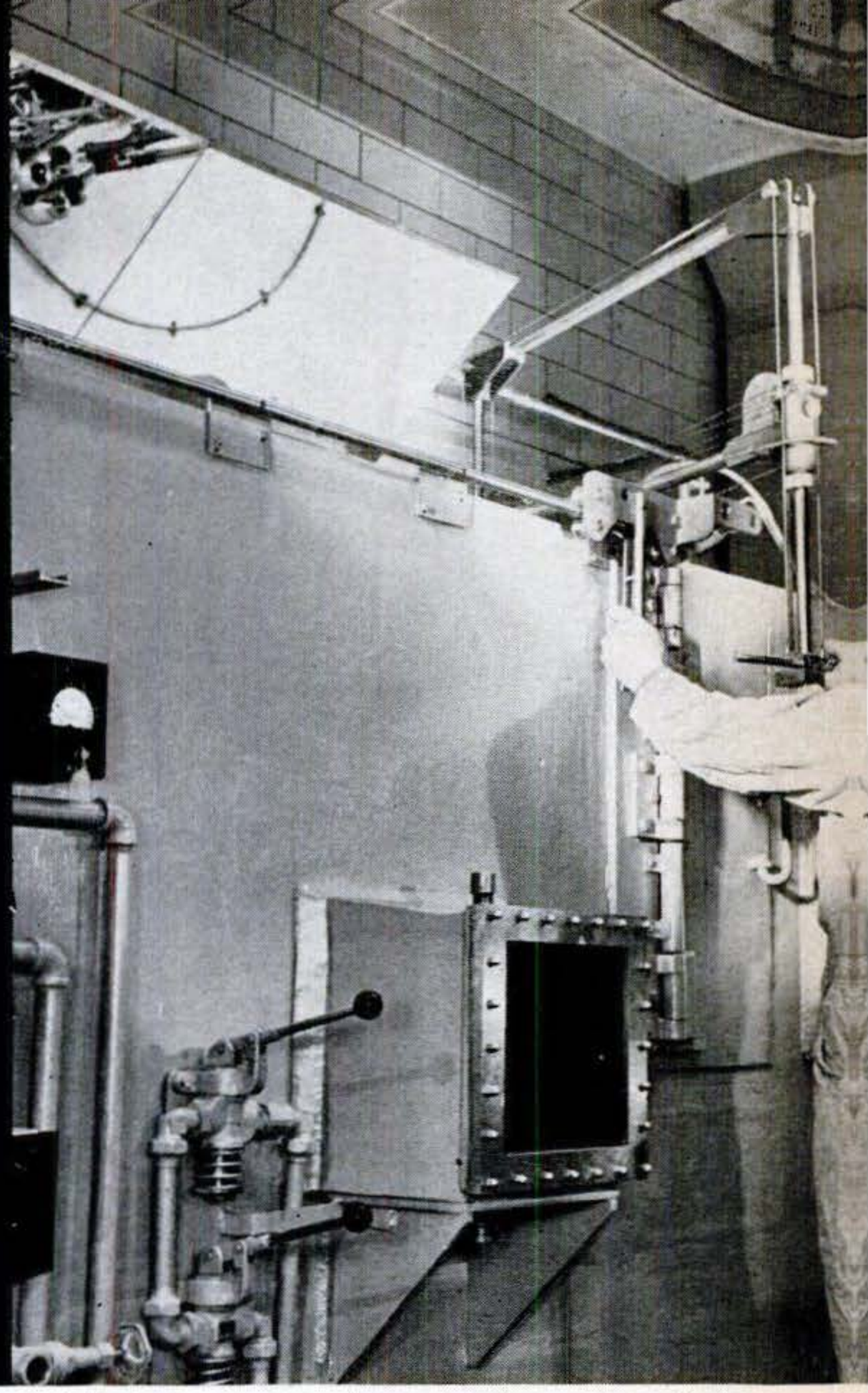
1 **A concrete partition** two feet thick protects clerks from gamma radiation emitted by isotopes kept in bottles. Area is well ventilated whenever lids over bottle trays are open.

4 **Glass pipette** at left removes required amount of liquid containing isotopes from storage bottle and puts it in a small bottle for customer. The device at right caps and uncaps the bottles.

5 **Tongs then carry** the tiny, capped shipping bottle past meter that measures radiation from it, and place it inside a heavy lead cylinder in a strong wooden box.





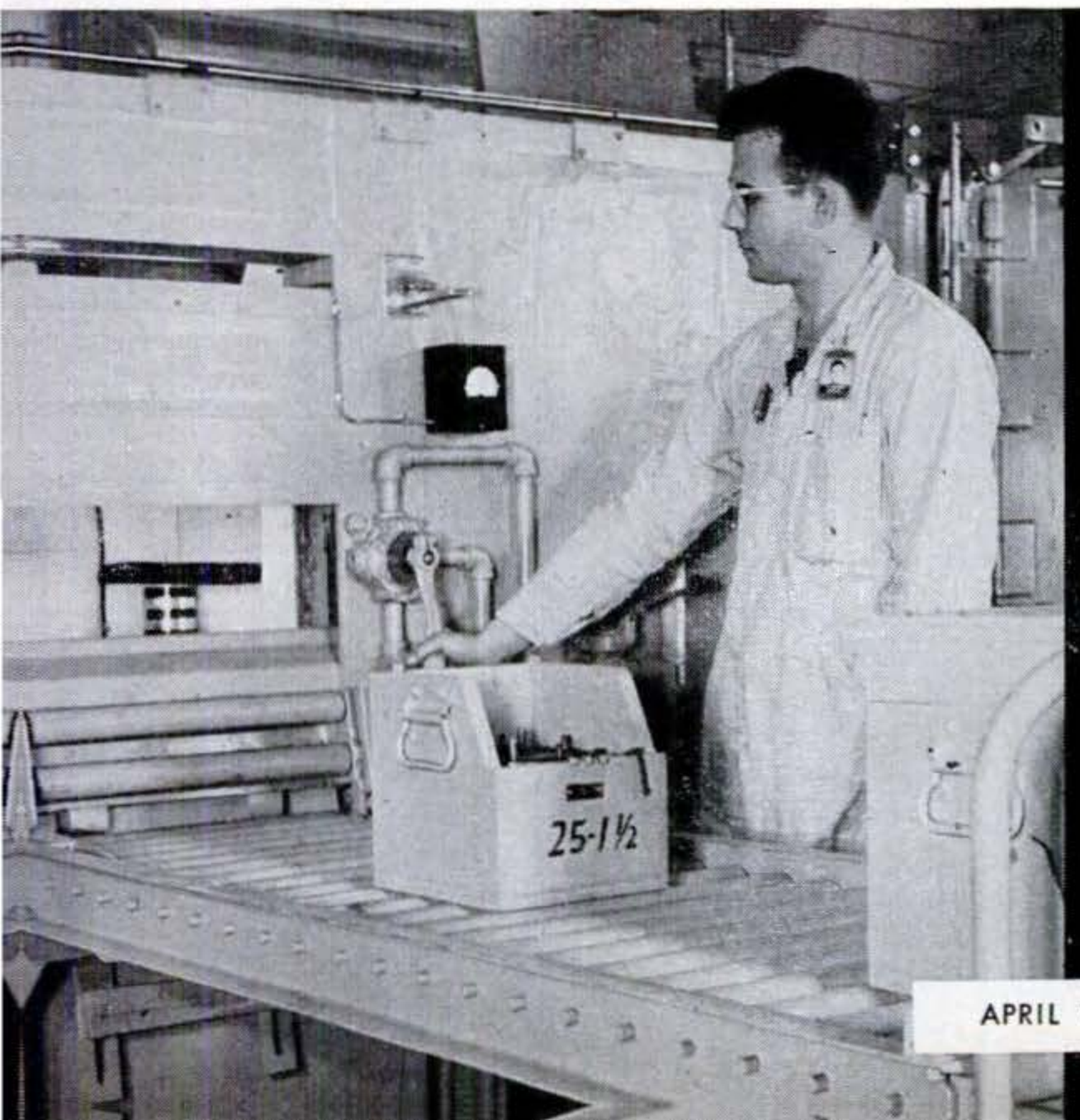


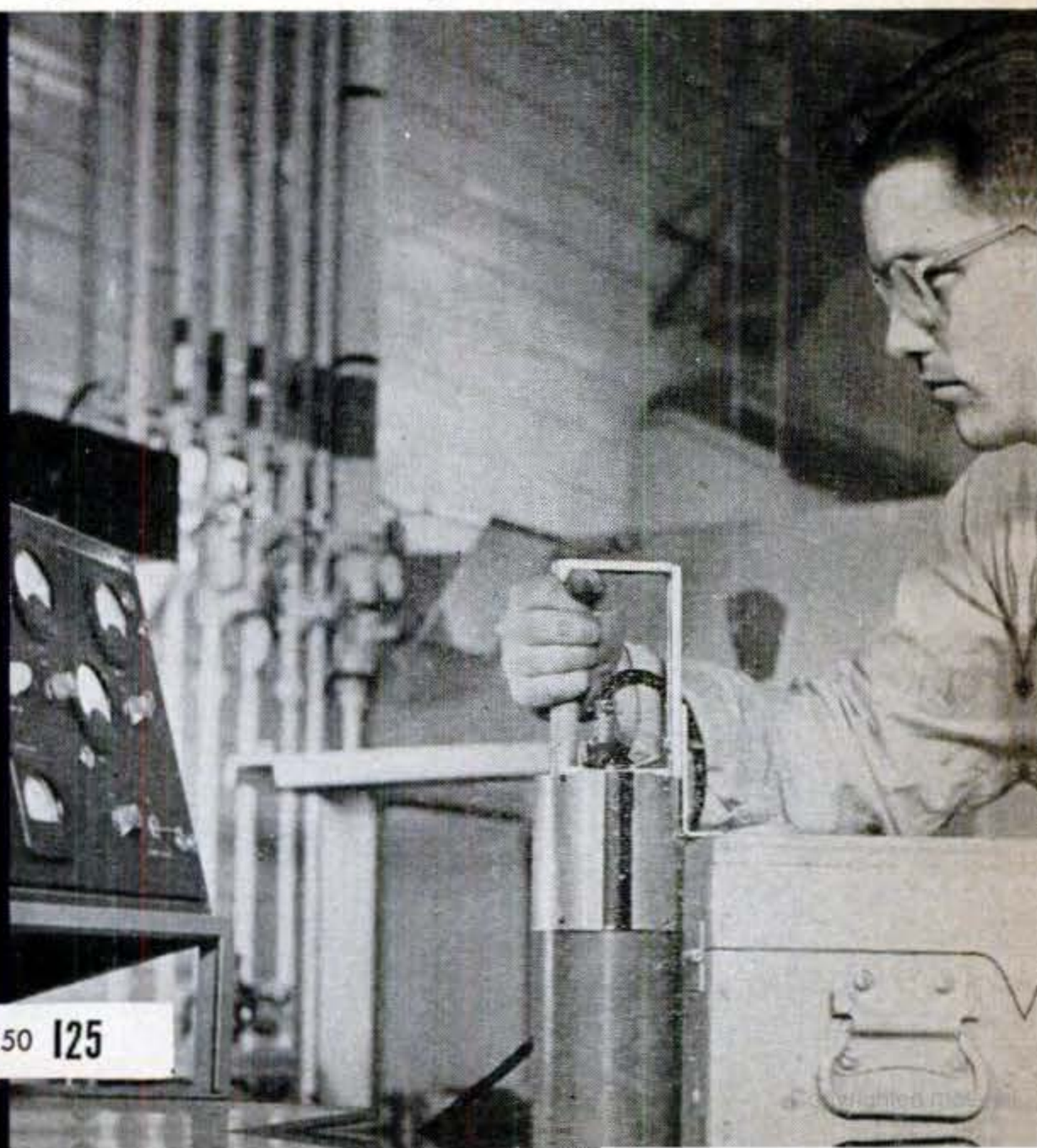
**2 To fill a customer's order,** a storage bottle is lifted out with tongs. Mirrors and periscopic devices enable the operator to see that his tongs take the right bottle from the tray.

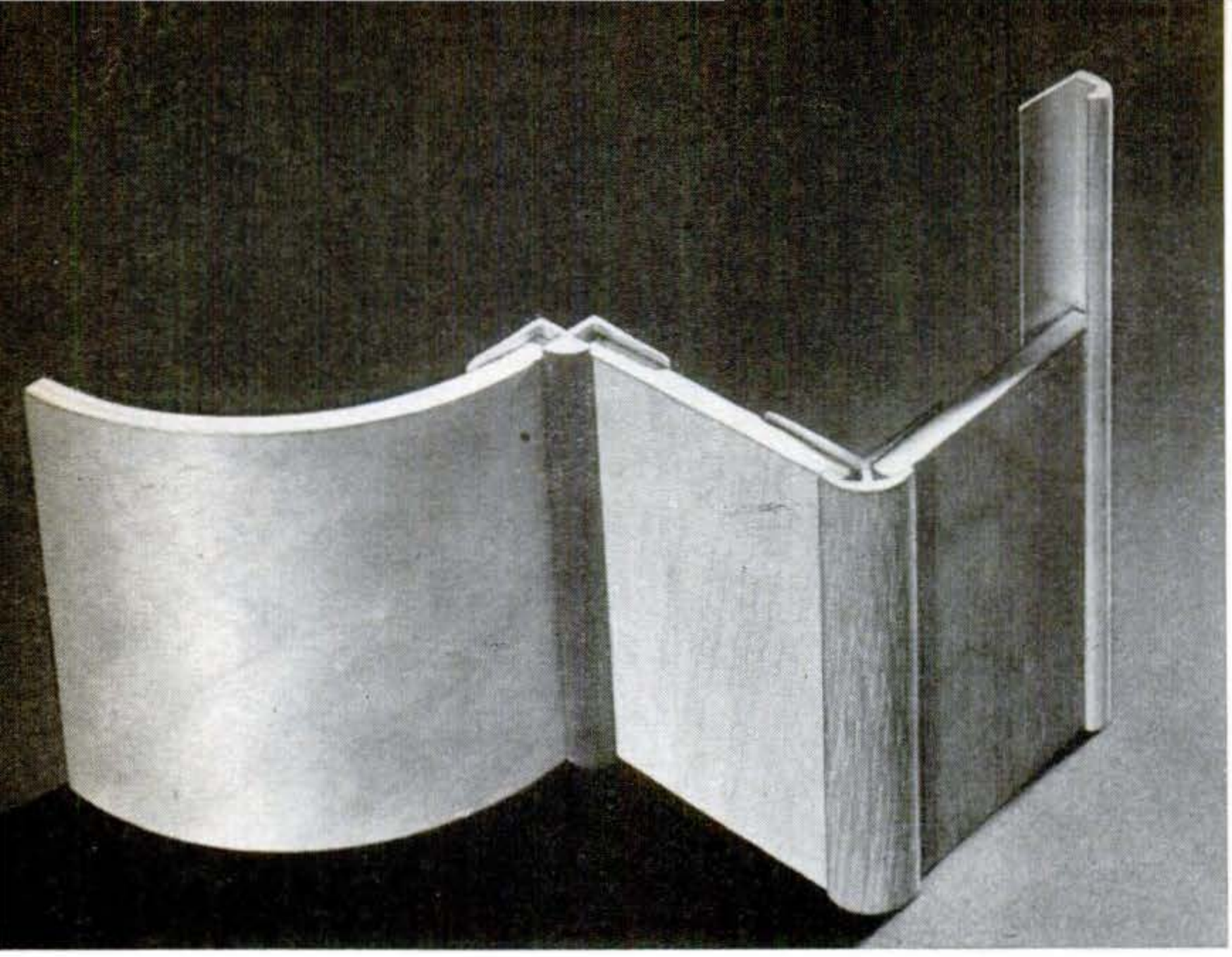
**3 Tongs are run along track** on top of the wall to transfer a bottle of the hot stuff from the storage trays to the part of the shop where it is measured out and prepared for shipment.

**6 Hydraulically operated** lead door in the barricade is raised, at last, and the box is taken out and sealed. Last year's shipments of isotopes from Oak Ridge were valued at $750,000.

**7 All sides of box are checked** before the expressmen get it, to make certain that it can be handled safely. Many isotopes decay rapidly, and most shipments are made by air.





**Sample moldings** show how different corner and edge problems are solved. Not shown is the "divider strip," which covers butt joints. By combining these moldings with curved plywood (left), many unusual coves, light troughs, and door and window trims can be easily made.

# Paneling Made Easy

You no longer have to be an expert carpenter to plywood-panel that living room or den. The old bugaboos that plagued home craftsmen tackling such jobs have now been licked by a special molding.

**In use, wall panel,** cut to correct size, is simply slid into molding that is already in place. The molding will hold the panel without additional nailing. Corner fitting is shown above, but same technique is used when butting two panels on one wall. These photos were made during the conversion of an old barn into a modern home for architect Lew I. Menges. All rooms in house except baths and kitchen are paneled.

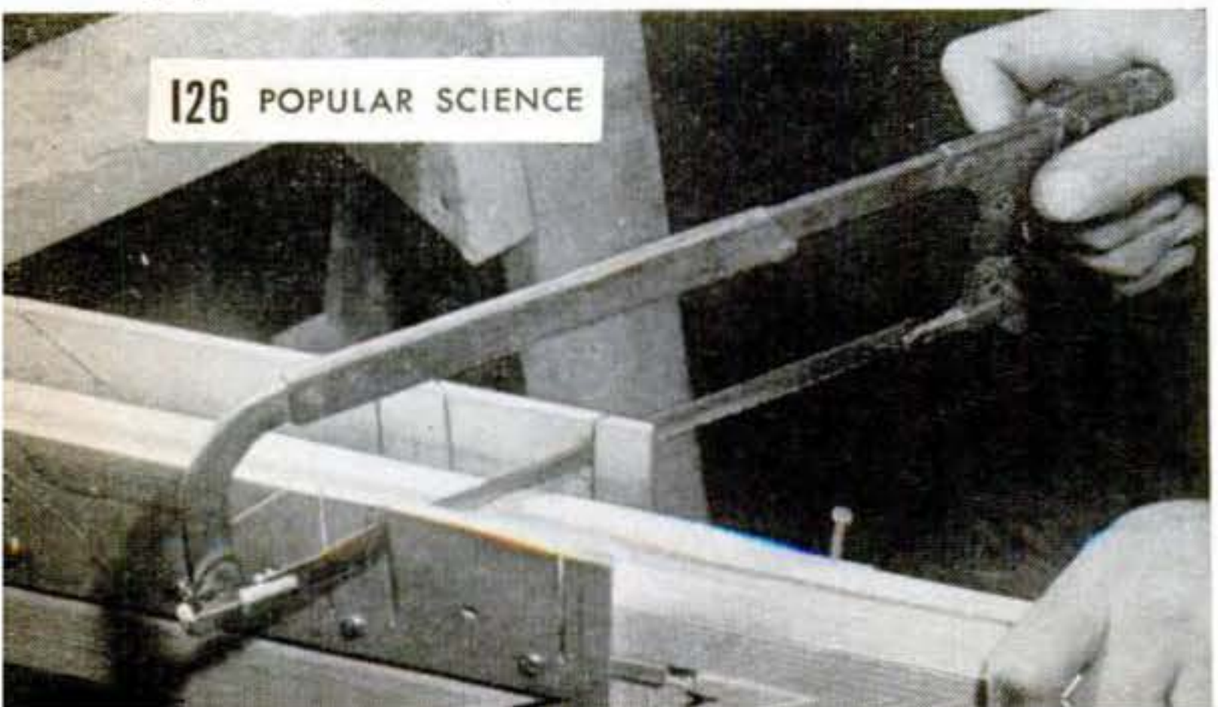
One style of these Weldwood® moldings covers butt joints, hiding the crack and allowing for expansion and contraction of the panels. Two other types make corner joints, inside and outside, eliminating the need for mitered edges. And a fourth covers the raw edge of overhanging or cove panels.

The moldings are made of aluminum with thin wood veneer bonded to the face. Several veneers are available.

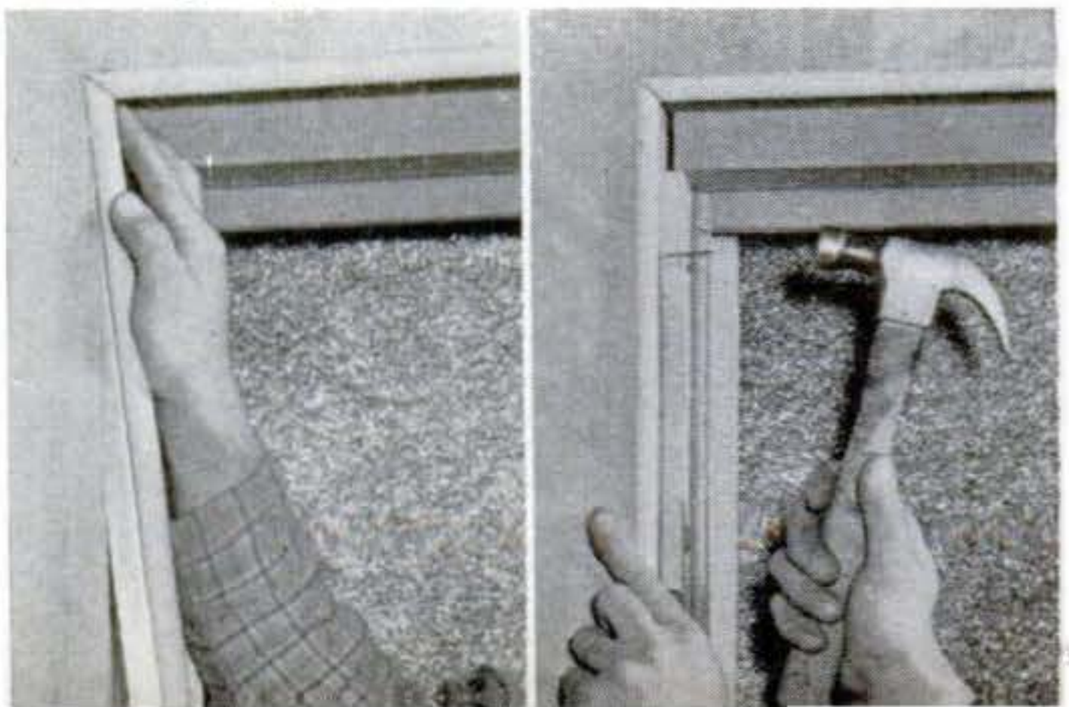
The moldings themselves, rather than the panels, are nailed to the wall studs—ordinary nails easily penetrate the soft aluminum. The plywood panels are held in the molding channel by friction. A few taps with a hammer will tighten up a loose channel. This way practically no nails need be driven through the panel, and a neater job results.

**Window-trim molding** (below left) is forced on the wall panel. The narrow "return" panel is already in place in its channel of this molding but can't be seen in photo. This window trim is one case where nails must be driven through the paneling as well as the molding. If the molding had been nailed on first, it would have been impossible to insert the return panel.

**An ordinary hacksaw** easily cuts the aluminum moldings. This one is being mitered for use on window trim. They are sold in seven- and eight-foot lengths to fit ¼"-, 13/16"-, and ¾"-plywood panels, and come in several veneers.







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**Fairchild employee guides one twin-wheel main gear of C-119 into trough on big turntable.**

**Plane is now ready** for compass compensation. Wakefield Engineering Co., Coeur d'Alene, Idaho, developed device to aid compass swinging.

**Heavy plane turns easily** on plastic bearing on bronze bearing plate. Compensator is used to check other navigation equipment too.

# *Turntable Gives Plane's Compass Quick Check-Up*

TO CUT the periodic chore of "swinging the compass" in an airplane, the Fairchild Aircraft Division at Hagerstown, Md., has installed a semi-automatic compensator. A job that took six hours can be done now in 90 minutes.

Compass swinging means comparing the readings of an aircraft compass with actual magnetic readings on various headings. A compass must be placarded for its inaccuracies because metals and circuits in the airplane itself cause it to deviate. Heretofore, this meant aligning the wheels with various directions indicated by radial lines on an airport ramp and calling the readings to the pilot.

With the new system, the twin wheels on one side of an Air Force C-119 are troughed on a turntable. An electric remote indicator linked to the turntable reports the correct magnetic bearing to the cockpit. Crewmen need only wheel the plane around, using the turntable as a pivot, as the pilot progressively notes the errors of his compass.



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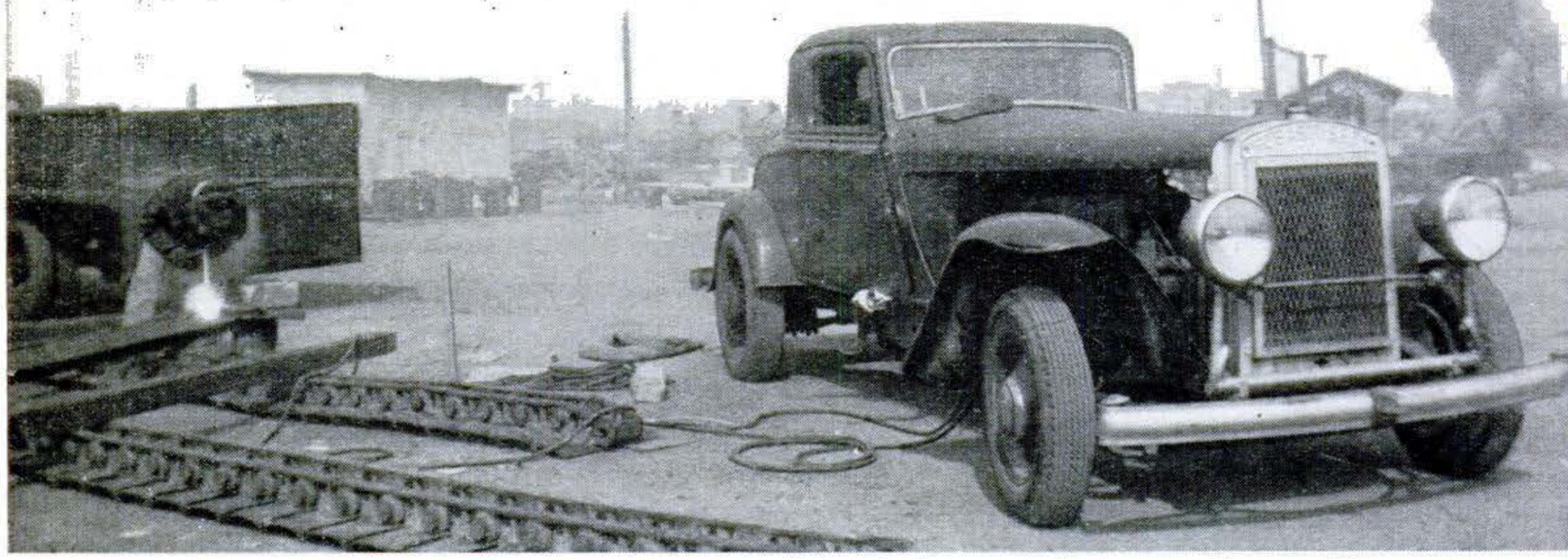
**Is it some sort of hot rod? That's what many people ask when they first see Paul Golding's homemade welding car.**



**Golding on the job. His odd-looking car is equipped for both arc and oxy-acetylene welding.**

# Welding Shop Rides to Work

***By Paul Golding***

WHEN heavy machinery requires welding, you can't always haul it to a repair shop. But you can haul the shop to the machinery. That's how I make part of my living.

There are other kinds of mobile welding rigs, but my particular shop-on-wheels attracts lots of attention. Occasionally a traffic cop waves me over and asks:

"What sort of hot rod is *that?*"

"Just junk I've picked up," I tell him, as he stares at the long, 87-inch hood. Then I explain that he is gazing at a Buick chassis, Dodge body, Reo radiator shell, Pontiac front fenders, and Ford front and Buick rear wheels. The outfit cost around $3,000.

The secret of a satisfactory mobile welding outfit like mine is two-fold. The car must be large enough to carry both the engine and power generator. And the welding outfit must have sufficient power to handle big jobs. Such an outfit can be mounted on a trailer, and often is, but for this you still need a tow car. Mine combines both in one.

I started off by picking up a wrecked 1932 Buick 90. I immediately tossed aside its engine, however, because I planned to use the welding rig's engine to drive the car as well as the power generator. Then I bought a 300-amp. DC arc welder with a stationary Chrysler gasoline engine. The 300-amp. unit puts out enough juice for fairly heavy jobs.

The big problem was how to mount the outfit. For nearly eight months during spare hours I cut and tried. The welder was longer by 31″ than the Buick engine I had removed. I gained 15″ by attaching gussets and plates to support the welding engine in front. But that wasn't enough. To make up the difference, I shortened the drive shaft and moved the transmission back 16 inches. The latter change made it necessary to adjust the length of the brake rods, the steering arms, and steering column.

To carry the heavier load imposed on the engine when it is used to drive the car, I installed a second flywheel, fitting it to the rear of the armature shaft. This was turned from mild steel. The toughest job was adapting the Buick clutch to the new flywheel.

Even though the flywheels and armature weigh around 500 lb., they can turn pretty fast. To lessen the chance of an accident, the engine was governed to 1,500 r.p.m., just fast enough to drive the car 41 m.p.h.

All in all, I'm very pleased with the outfit. I've tooled it 30,000 miles to and from jobs in and around Alhambra, California. And the jobs have paid off well—both in money and satisfaction.



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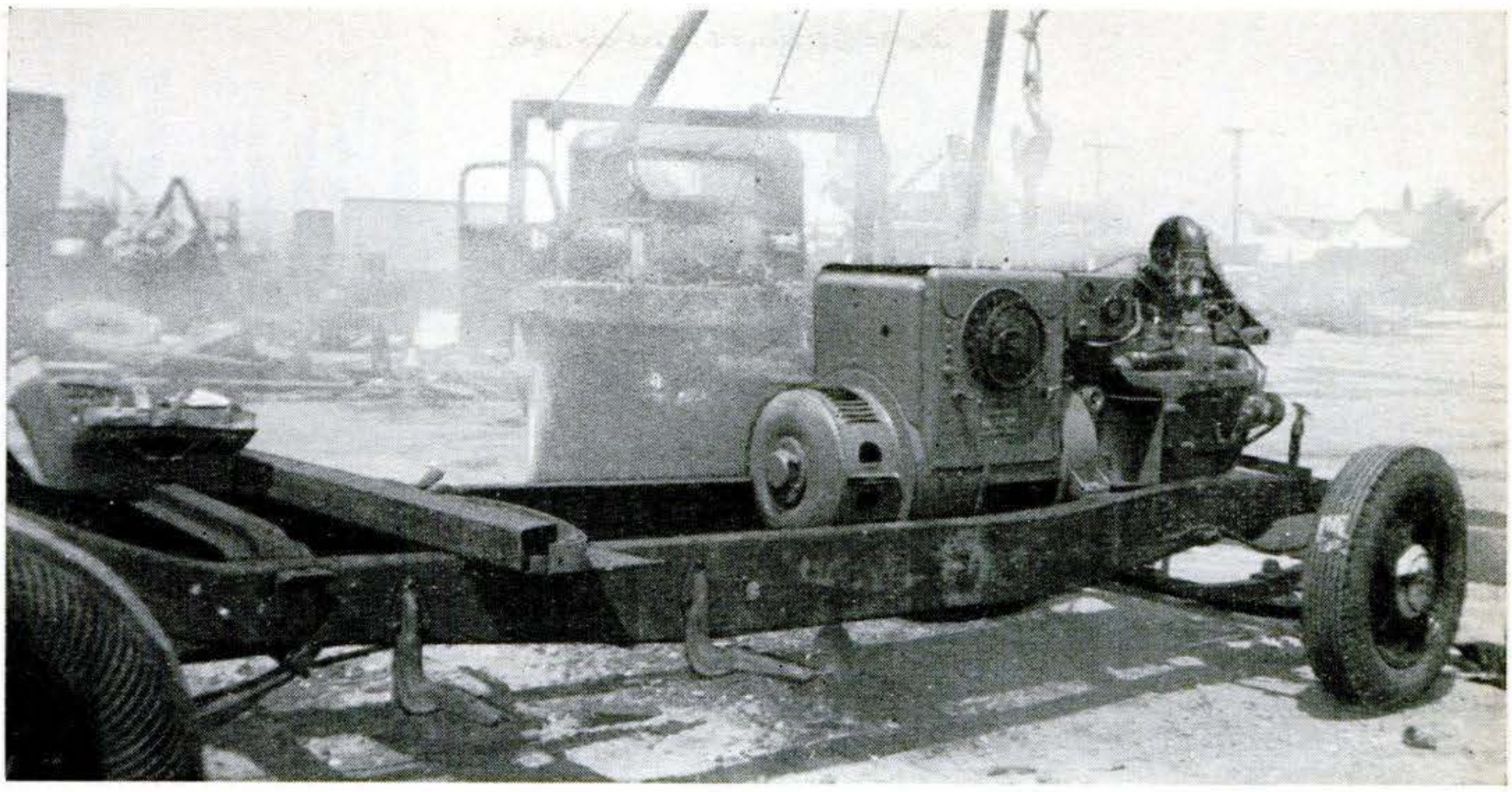
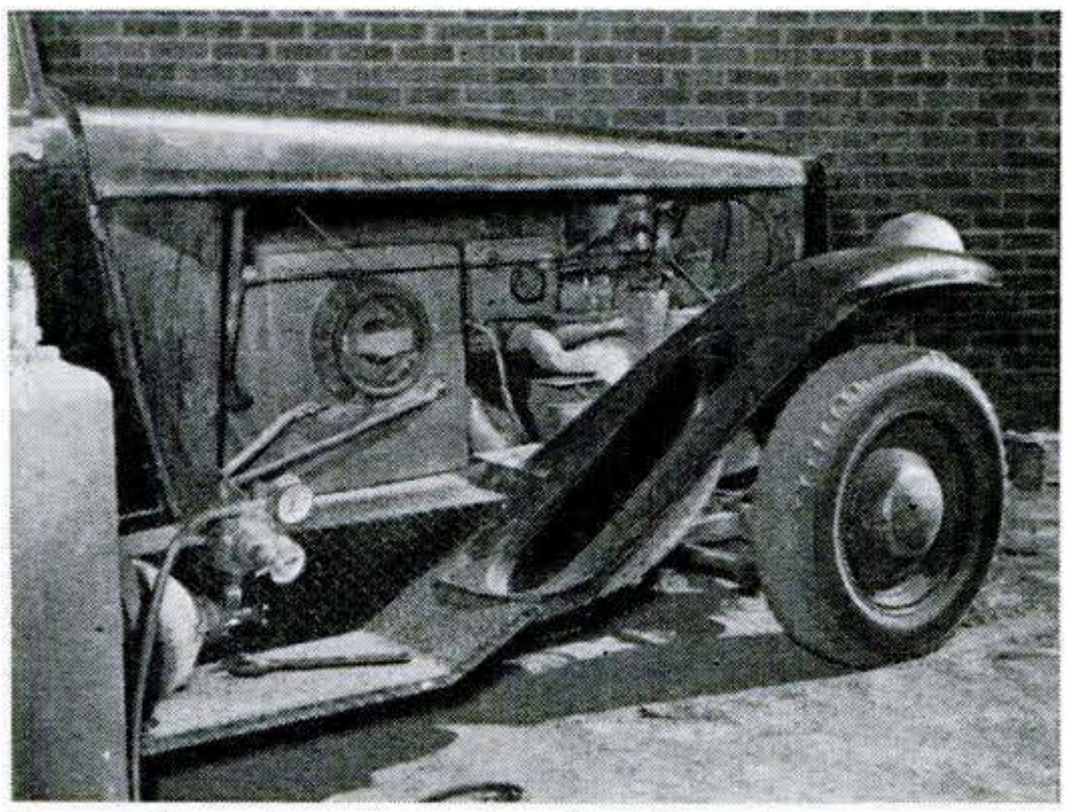
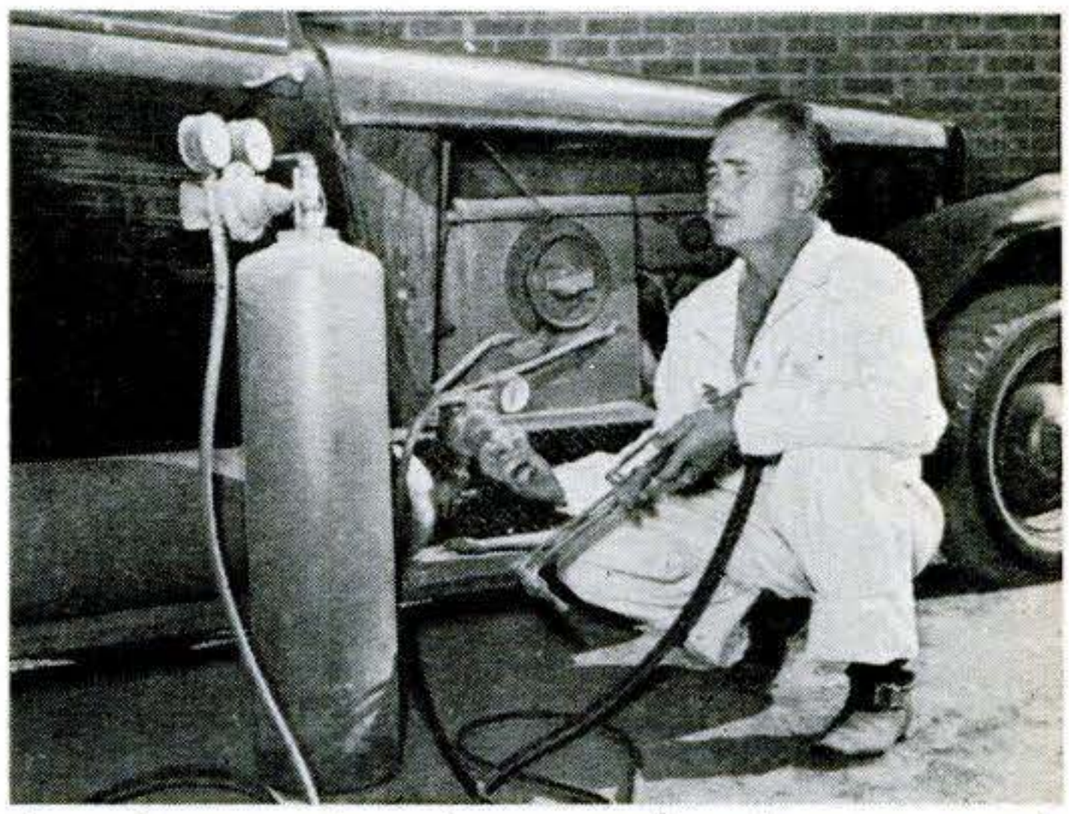


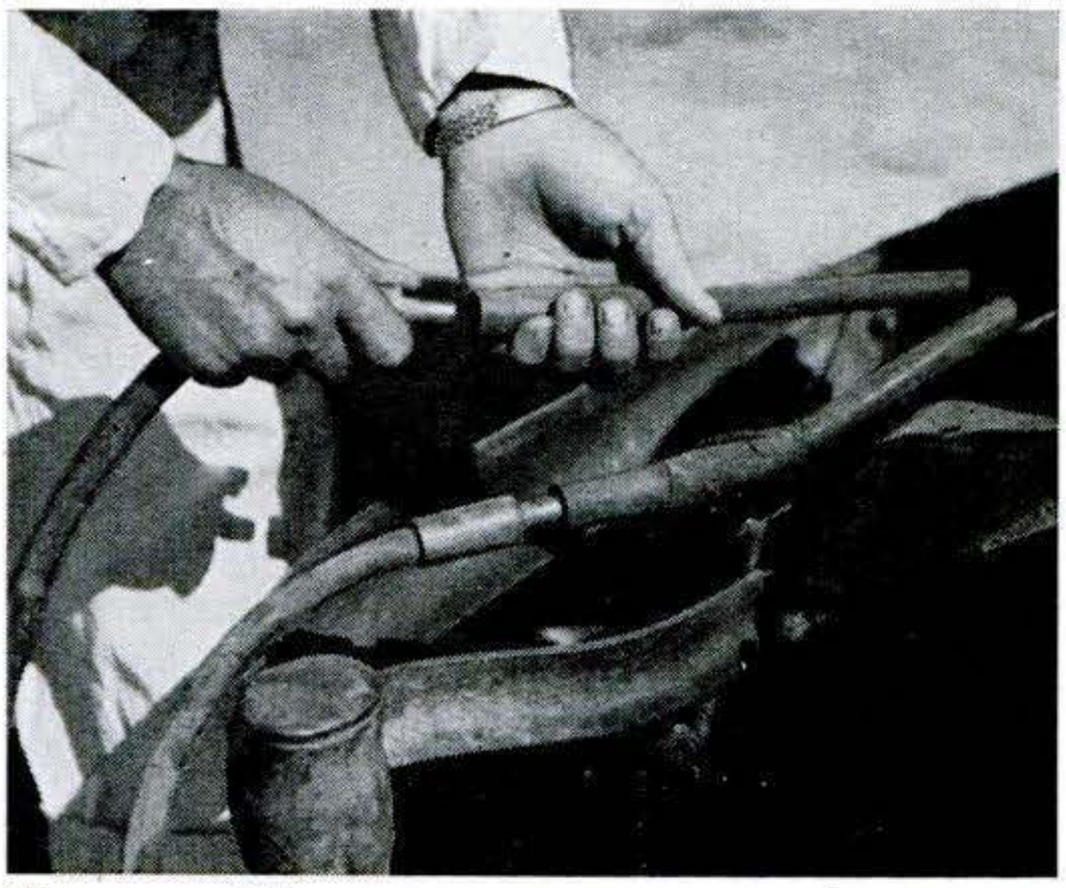
**This was the start of the welding car—a Buick chassis and Hobart gasoline-driven arc welder.**



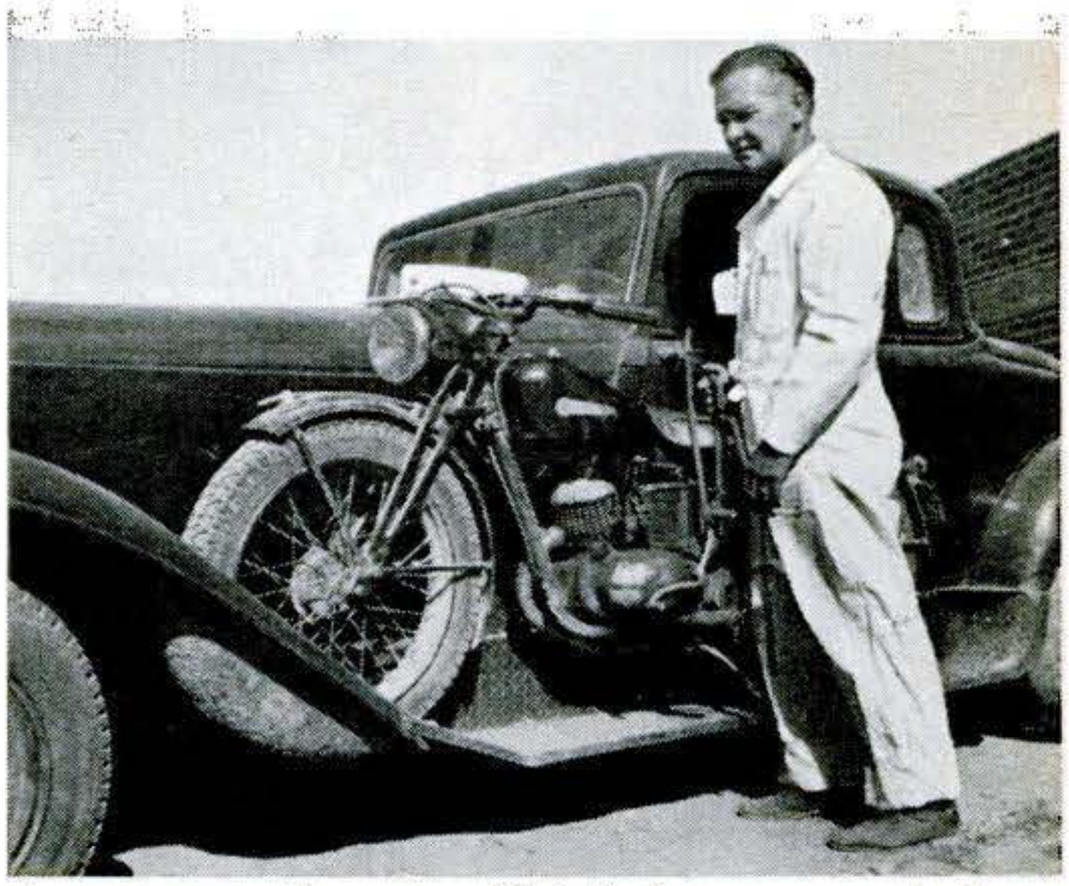
**Long hood** covers 6-cyl. Chrysler stationary engine and 300-amp. DC generator that puts out juice for arc welding. Rheostat on the welder permits 1,000 adjustments of the power output.



**Acetylene tank** in foreground and oxygen tank on running board are quickly hooked up for a cutting or welding job. When not in use, the acetylene tank is carried on the rear of the car.



**Power cables** connect to terminals at rear bumper. The lines are long enough to permit welding up to 100 feet away from the car.



**A motorcycle too.** If job lasts several days, Golding goes home at night on a light motorcycle. Its front wheel rides in tire well.



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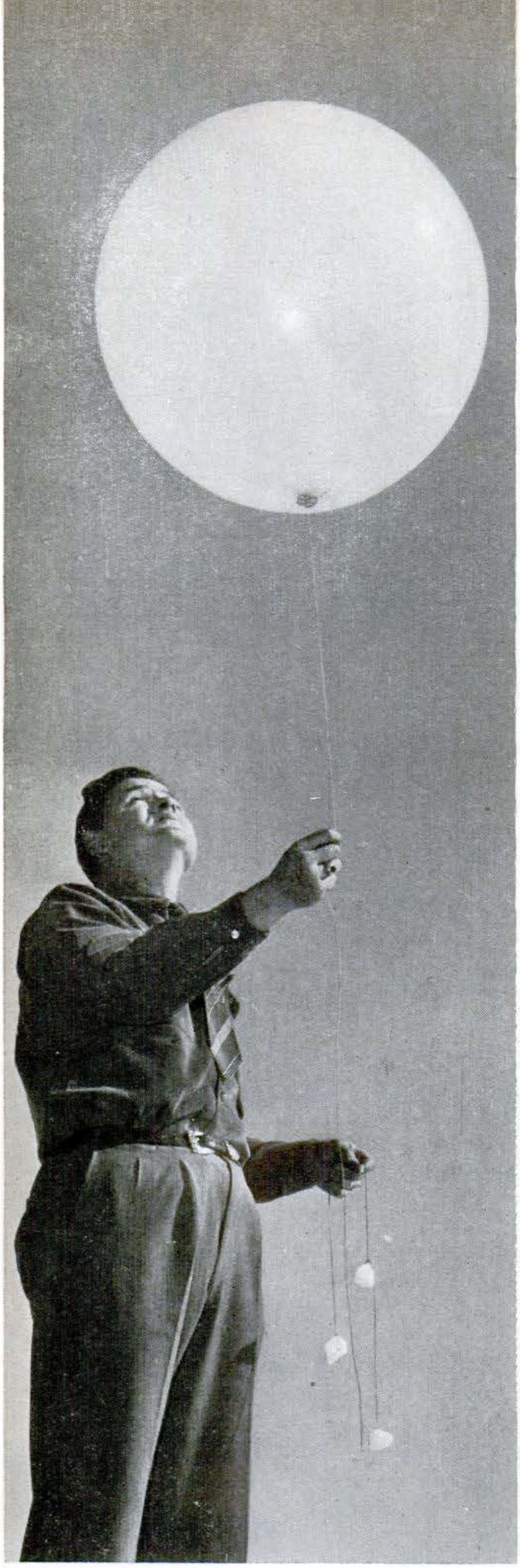

**This helium-filled balloon** lifting a few pieces of dry ice into the sky is typical of the simple equipment that can be used to "seed" a rain cloud. Many other methods have been used by the rainmakers—sprinkling dry ice from an airplane, sending up silver-iodide smoke from the ground, even shooting dry ice into a cloud with a Very pistol. Picking right cloud is tougher.

# Can We

**320,000,000,000 gallons of rain followed one test of cloud-seeding—but maybe it would have rained anyway.**

***By Martin Mann***

*Photos by W. W. Morris and General Electric Co.*

CAN we make it rain?

"Yes," says Dr. Irving Langmuir, Nobel-prize-winning consultant to the General Electric Research Laboratory and the Army-Navy Project Cirrus, "—provided conditions are right."

"Maybe," says Dr. F. W. Reichelderfer, chief of the U. S. Weather Bureau. "No tests so far prove to our satisfaction that rainfall has really been created by man. It might have rained anyway."

But despite this sometimes acrimonious debate over whether "seeding" a cloud with a few hunks of dry ice makes it rain, dozens of people all over the world are going ahead and doing just that.

In Honduras, Joe Silverthorne made more than 200 flights for the United Fruit Co. There was rain, plenty of it. More important, the rain clouds were set off before they could build up into "blowdowns"—costly wind storms that knock bananas off the trees.

### *It Works in Cuba*

In Cuba, agricultural expert Herman Cohen has been seeding the 200,000-acre Central Ermita for several years. He claims excellent results, including one side excursion to fill the reservoir of a nearby town.

In the Rogue River Valley of Oregon, pilots Brandau and Kooser undertook a year's seeding for the local fruit growers. There was no ruinous hail along the Rogue that year, while bad storms hit nearby.

In California, the California Electric Power Company has seeded clouds over Owens Valley since 1947. Object: to fill reservoirs that supply its hydroelectric plants. Seeding has increased rainfall 12 to 14 percent, reports the company.

In Hawaii, Luna B. Leopold and Maurice



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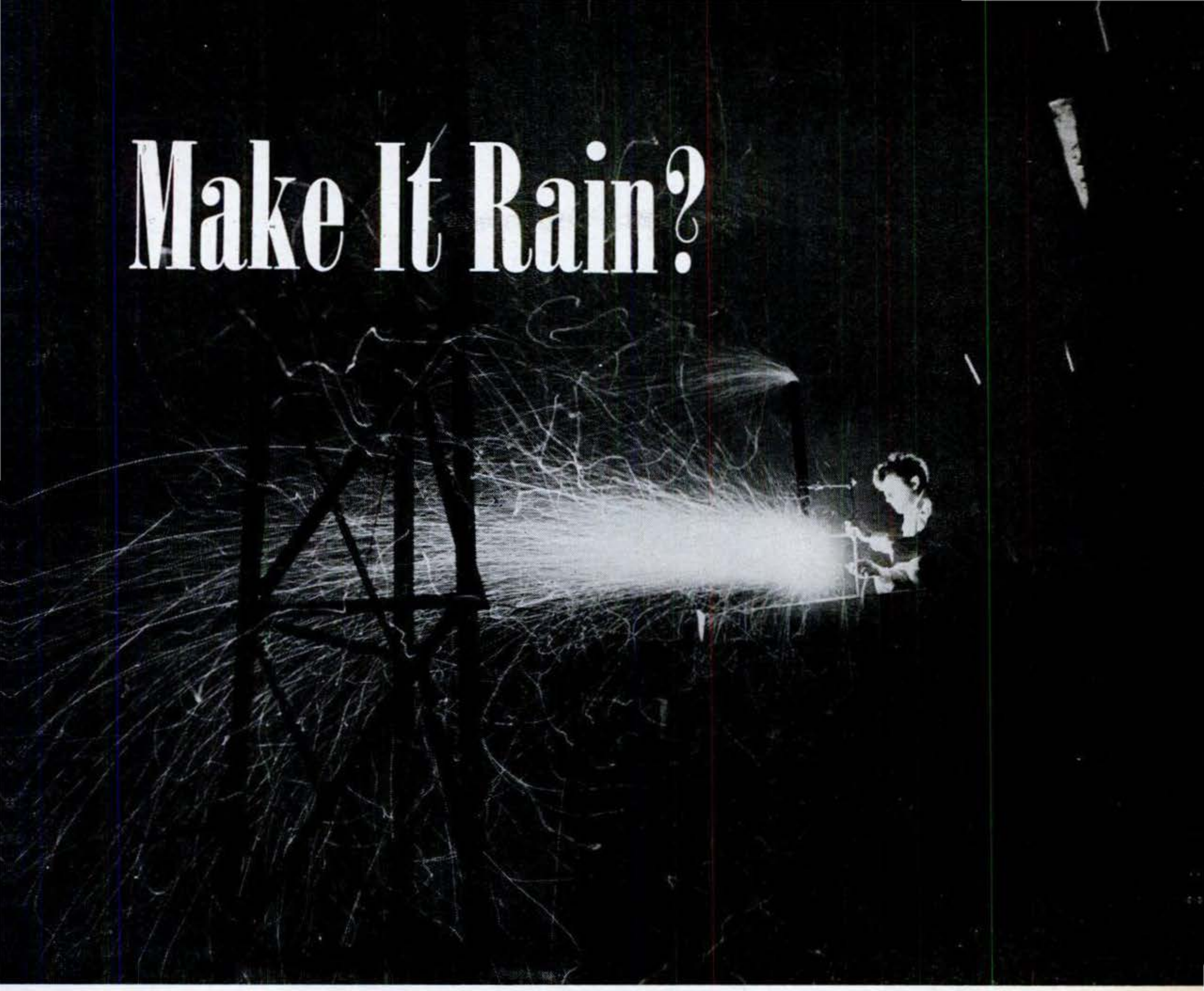
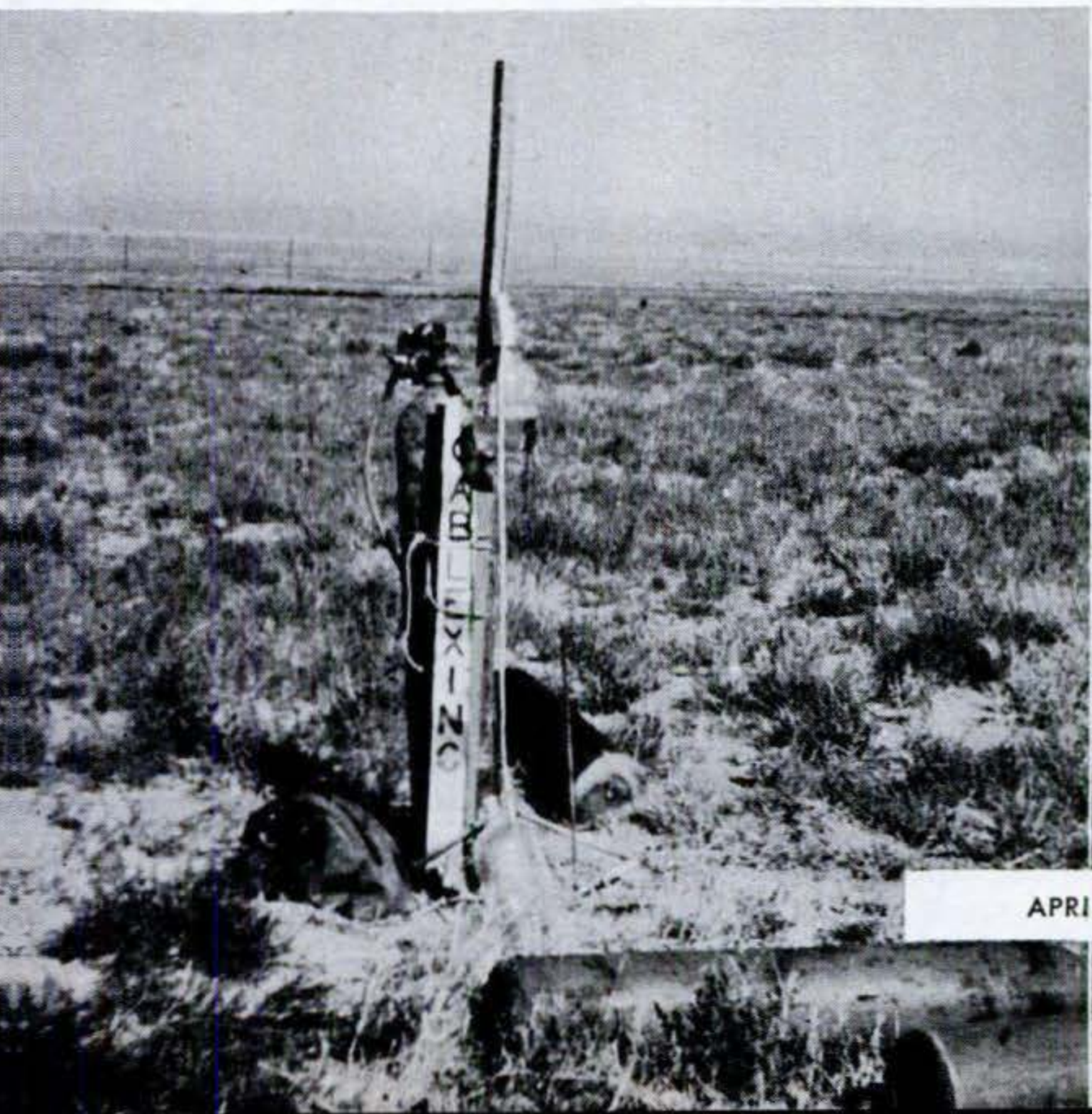
# Make It Rain?



**Silver-iodide generator** operating at night creates a spectacular shower of sparks. The microscopically small particles of silver iodide are carried by air currents into clouds over a wide area.

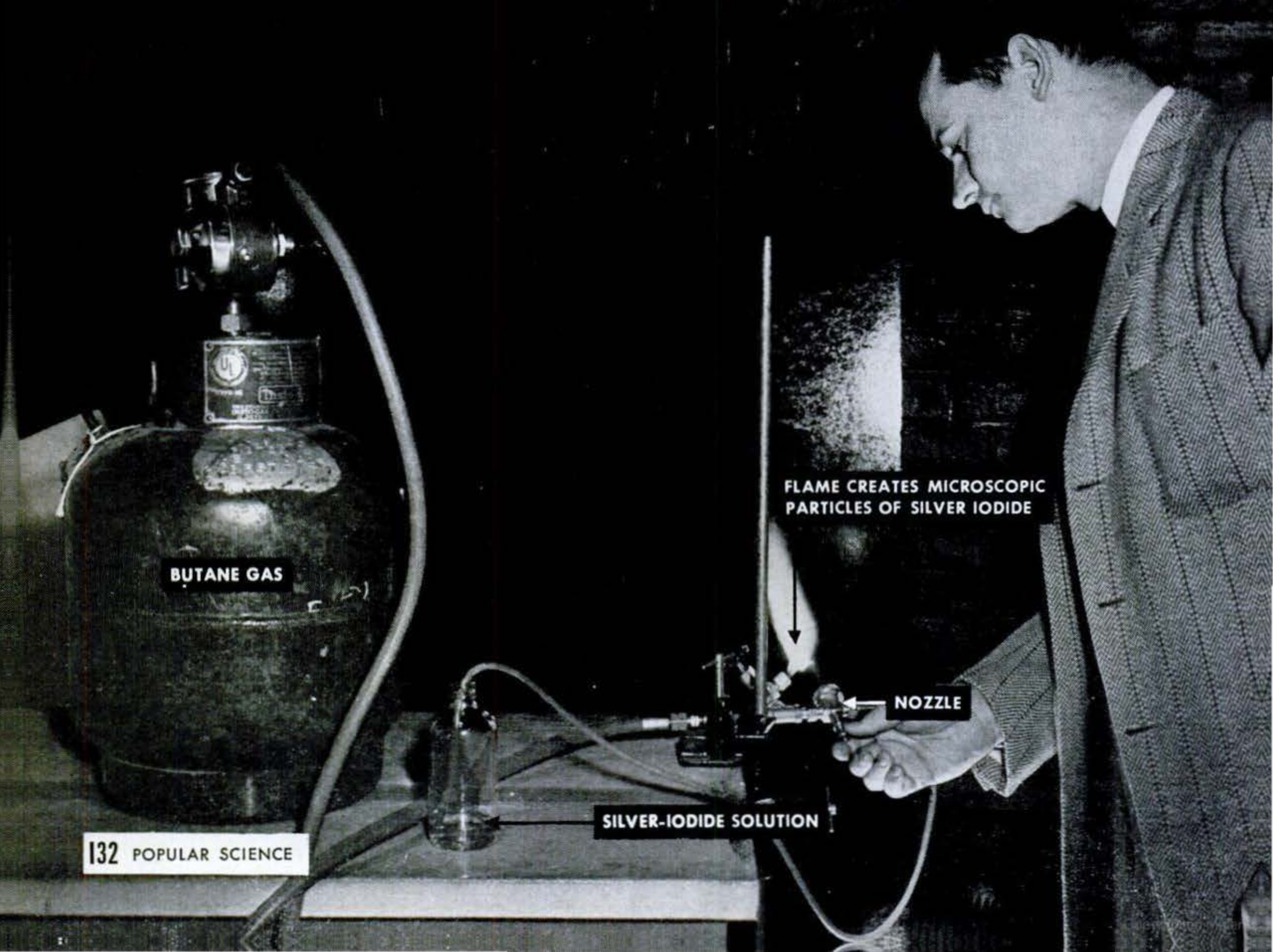
**Most striking evidence** of man's ability to create rainfall came from test last July 21, which was followed by 320 billion gallons of rain. Silver iodide generator is shown below (left) during its 13-hour run that day. Several showers—dark gray vertical streaks under the cloud—can be seen falling from a seeded cloud in official Signal Corps photo at right below.

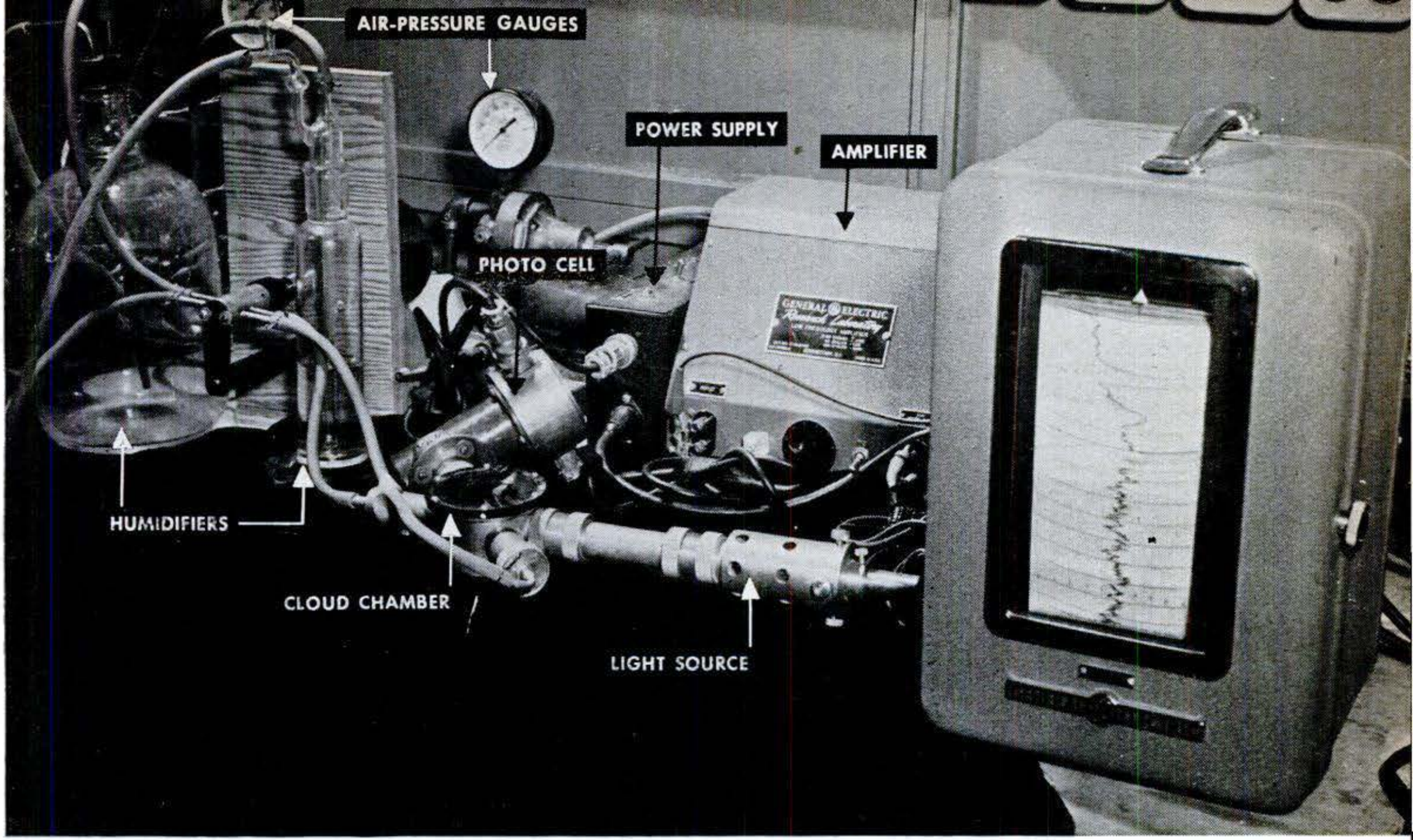


**An air fleet** that includes this B-17 being loaded with dry ice, two other four-engined bombers, and one lighter craft is kept busy on the "cloud-modification" flights of Project Cirrus.

**Bagful of dry ice** is poured into simple dispenser inside B-17, from which it is released in thin stream. Few ounces of dry ice, sprinkled into the right kind of clouds can make rain.

**Latest silver iodide generator** is demonstrated by its inventor, Dr. Bernard Vonnegut. He is adjusting blowtorch that burns silver iodide solution (from bottle) with butane gas from tank.






**Among many instruments** developed for Project Cirrus is condensation-nuclei counter above. Expansion chamber makes moisture condense on nuclei. Resulting cloud is gauged by photo cell.

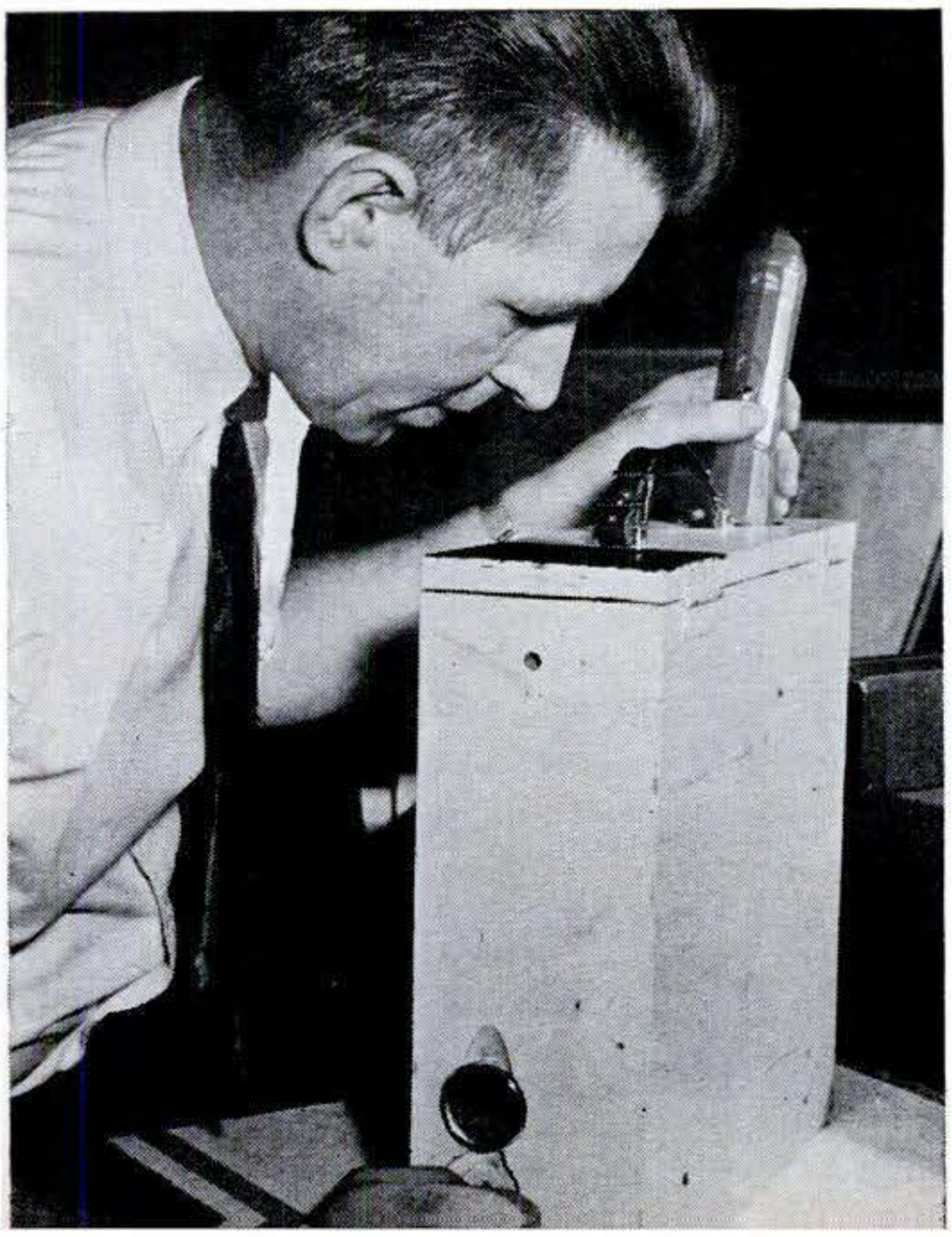
H. Halstead seeded clouds over pineapple plantations, first with dry ice, later with plain water. Again there was rain.

But the Weather Bureau takes a dim view of all this. Dr. Reichelderfer doesn't say it would have rained anyway. He simply maintains there's no proof it wouldn't have.

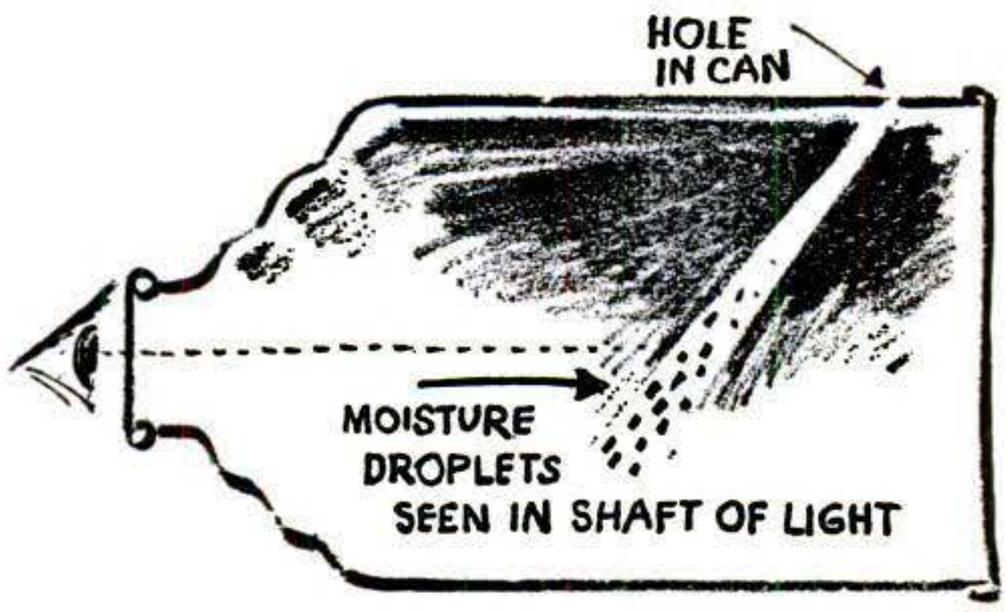
Then Dr. Reichelderfer points to the Bureau's own experiments: two years' testing in Ohio, one year each in California and Alabama. None produced "rainfall of economic importance." Additional trials are now being planned, probably for this summer in Florida. Great pains are being taken to devise tests that will "separate the man-made rain from God's rain."

Dr. Langmuir's reply to such doubting-Thomases is apt to be explosive. "Of

**Counter for sublimation nuclei**—ones that cause moisture to freeze, not condense—is being developed by Dr. Vincent Schaefer (below). Sublimation nuclei are kind needed to cause rain.



**Beer can with nail hole** also counts condensation nuclei. Just blow into can, take finger off hole to reduce pressure quickly, and estimate nuclei concentration by judging cloud visually.



course they don't get rain! They're not doing it the right way." Then he hauls out his own data—rainbarrels full.

The most dramatic of the Project Cirrus tests took place a year ago in New Mexico. Following one seeding, on July 21, 1949, some 320 billion gallons of rain fell!

At 5:30 A.M. on that day, a silver-iodide generator was started on the desert about seven miles outside Albuquerque. Here is the timetable of what happened next:

*8:30 A.M.* A large, towering cloud began to form 25 miles away, near the Manzano Mountains.

*9:57 A.M.* The cloud shot up suddenly, rising 1,200 feet a minute.

*10:06 A.M.* The radar screen showed the first echo from the cloud—rain reflects radar waves like a solid target.

*10:10 A.M.* The first flash of lightning was seen. "Very heavy rain" fell to the ground.

*1047: A.M.* Rain in another cloud produced a radar echo.

Then, to quote from Dr. Langmuir's report to the American Meteorological Society, ". . . . from that time on during the day, there were an increasing number of rain storms giving very heavy showers in the neighborhood. During the late afternoon, 1.2 inches of rain fell at the station where the generator was located."

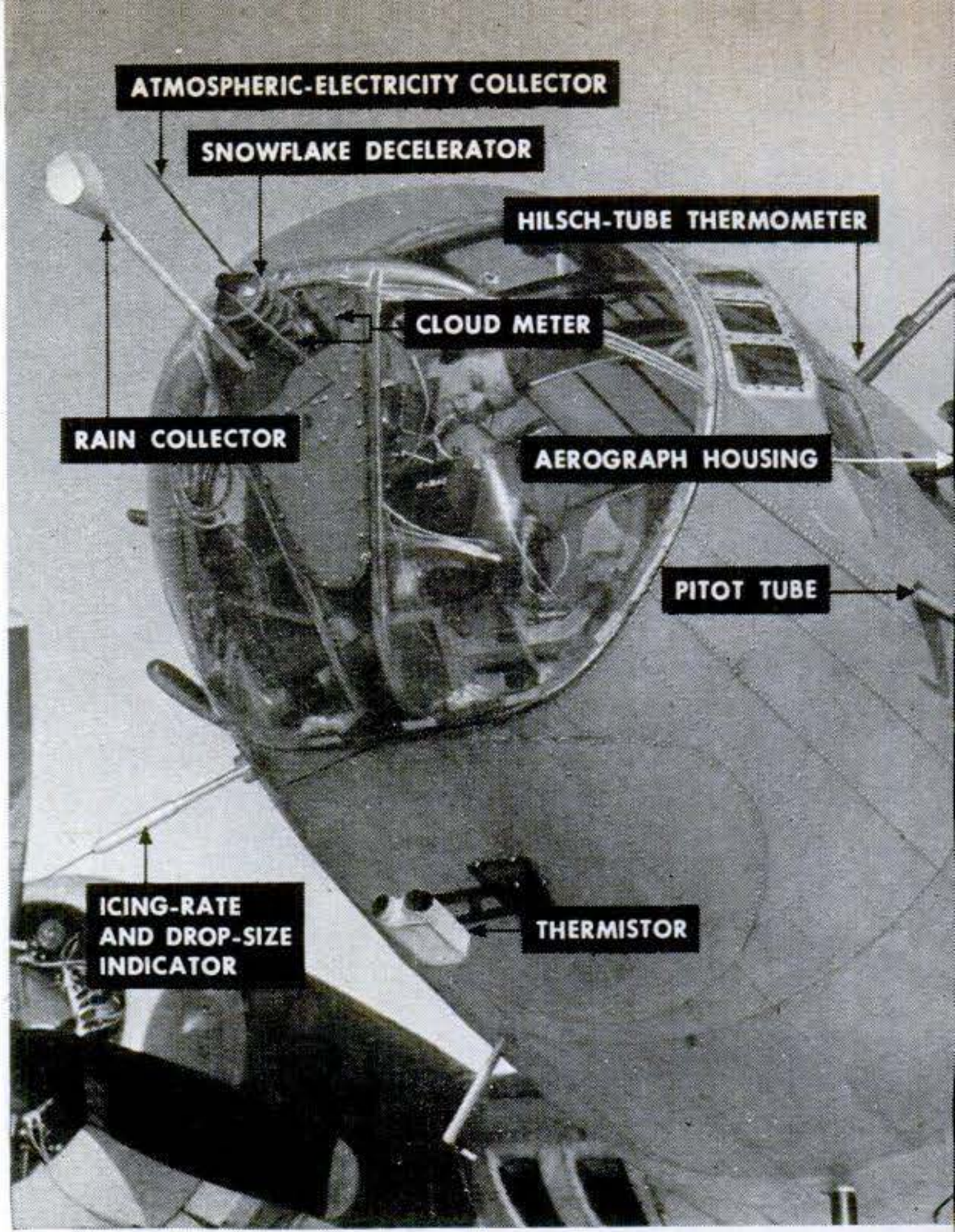
The storms were not limited to the area around Albuquerque, but spread over much of New Mexico, and possibly even farther.

### *Did Seeding Do It?*

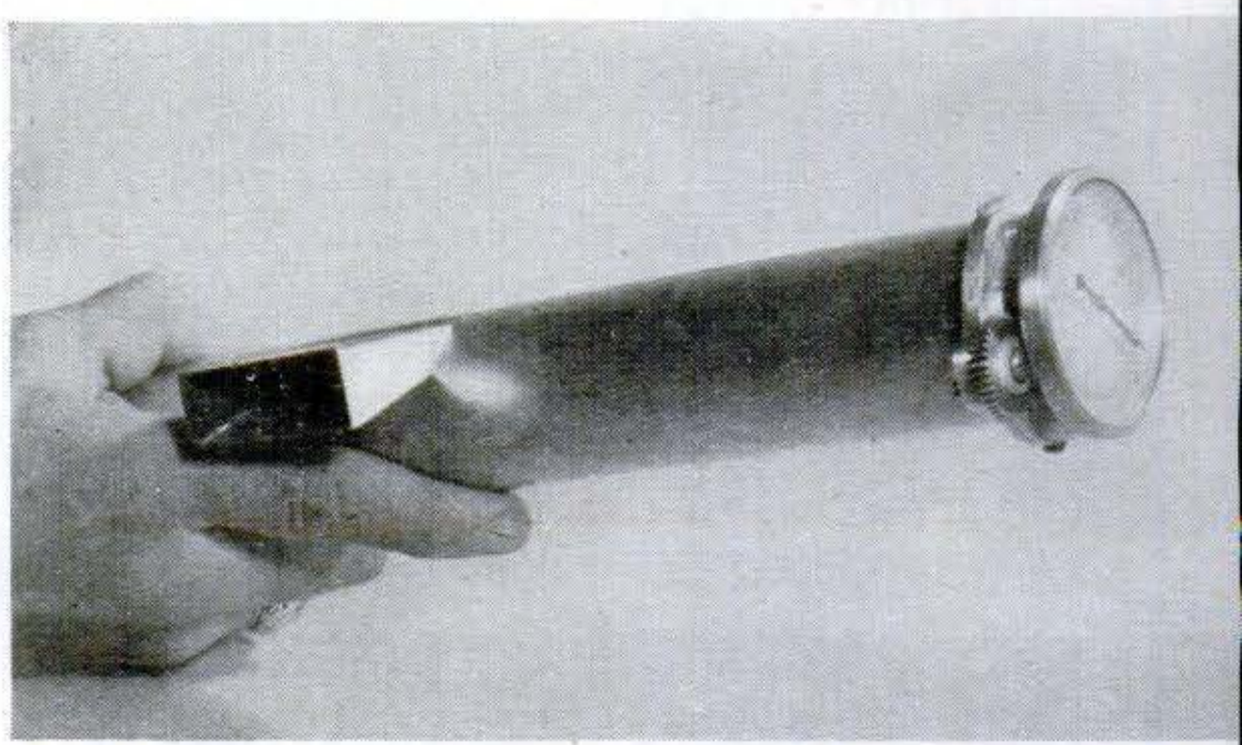
Still, there's that question: would it have rained anyway, without the seeding? Dr. Langmuir's answer is to divide up the area around Albuquerque into regions and compare the rainfall in each region on July 21 with the rainfall in the same region on the previous October 14. On that day similar seeding operations had been carried out from the same spot outside Albuquerque, and the same heavy rainfall had followed.

By using standard methods of statistical analysis, Dr. Langmuir could tell whether similarities in the rainfall pattern were merely coincidence, or whether the seeding itself had caused them to be alike. His results: the odds against a mere coincidence were 100,000,000,000,000,000,000,000,000,000,000,000,000,000,000 to one!

That early morning last July 21 was not at all unusual for New Mexico. Clouds containing plenty of moisture frequently form near the mountains. Yet it seldom rains.




**Nose of Project Cirrus B-17 bristles**—but not with guns. These are instruments for comprehensive study of clouds. One gadget slows down snowflakes, catching them whole for later study.



**Novel thermometer** uses Hilsch tube—"magic tube" that divides compressed air into hot and cold streams—to cancel effect of skin friction on air temperature outside a moving airplane.

As a result, New Mexico and much of the rest of the Southwest are arid, nearly desert. Yet this is fertile land. If seeding could increase the rainfall only a few inches a year, a vast new agricultural empire might be created. And, of course, what is true in New Mexico applies equally well to many other regions throughout the world. Cost? On July 21, the generator ran 13 hours. It used only ⅔ of a pound of silver iodide—worth $20.

Farmland from desert is only one of



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countless benefits possible with accurate control over clouds. Take hail, for example. A single storm can cause $5,000,000 damage in a few minutes (see PS, June '47, p. 82). Yet Dr. Vincent J. Schaefer, who started this whole business, thinks hail clouds are among the most suitable to work on. Seeding should turn the cloud into beneficial rain, removing the moisture before it has a chance to grow into hail.

The U. S. Forest Service invited Dr. Schaefer to Idaho last summer to look over the big, lightning-filled thunderstorms that start many serious forest fires. He thinks they, too, could often be converted into harmless, lightning-free rainstorms.

One hurricane has been seeded. It then changed its course sharply. However, there is no proof that seeding caused it to turn.

Military applications of seeding are fantastic: rain and fog might cripple an enemy while skies stayed bright on your own side of the lines. The air over bombing targets and landing fields almost certainly could be kept clear, for seeding can melt away clouds and prevent rain, too.

And of course there's the famous New York water shortage. Dr. Langmuir has said that rainfall in the watershed might be doubled by proper seeding. After considerable prompting (first from POPULAR SCIENCE, later from the newspapers), city officials have decided to "proceed immediately" with seeding investigations.

These intriguing possibilities of raising man from slave to master of the weather all stem from a series of discoveries made largely by the General Electric team of Drs. Langmuir, Schaefer, and Vonnegut.

### *Two Things Determine Rain*

They have learned that rain depends mainly on two things: the prevailing weather (wind, temperature, humidity), and on the "sublimation nuclei" in the air.

Sublimation nuclei are things that make the moisture vapor in a cloud turn into ice crystals, which may grow and then fall to the ground as rain. Ordinarily, the nuclei needed for a rainstorm are supplied by various natural dusts, or by tiny ice-crystal "seeds." The ice-crystal seeds are formed when a cloud gets so cold—about −38° F.—that its moisture vapor freezes by itself. Frequently, however, there are not enough natural nuclei to start rain. This is what happens so often in New Mexico.

The GE researchers found they could increase the chance of rain from a cloud by supplying *artificial sublimation nuclei*. When other conditions were right, the cloud could be "triggered" into rain artificially.

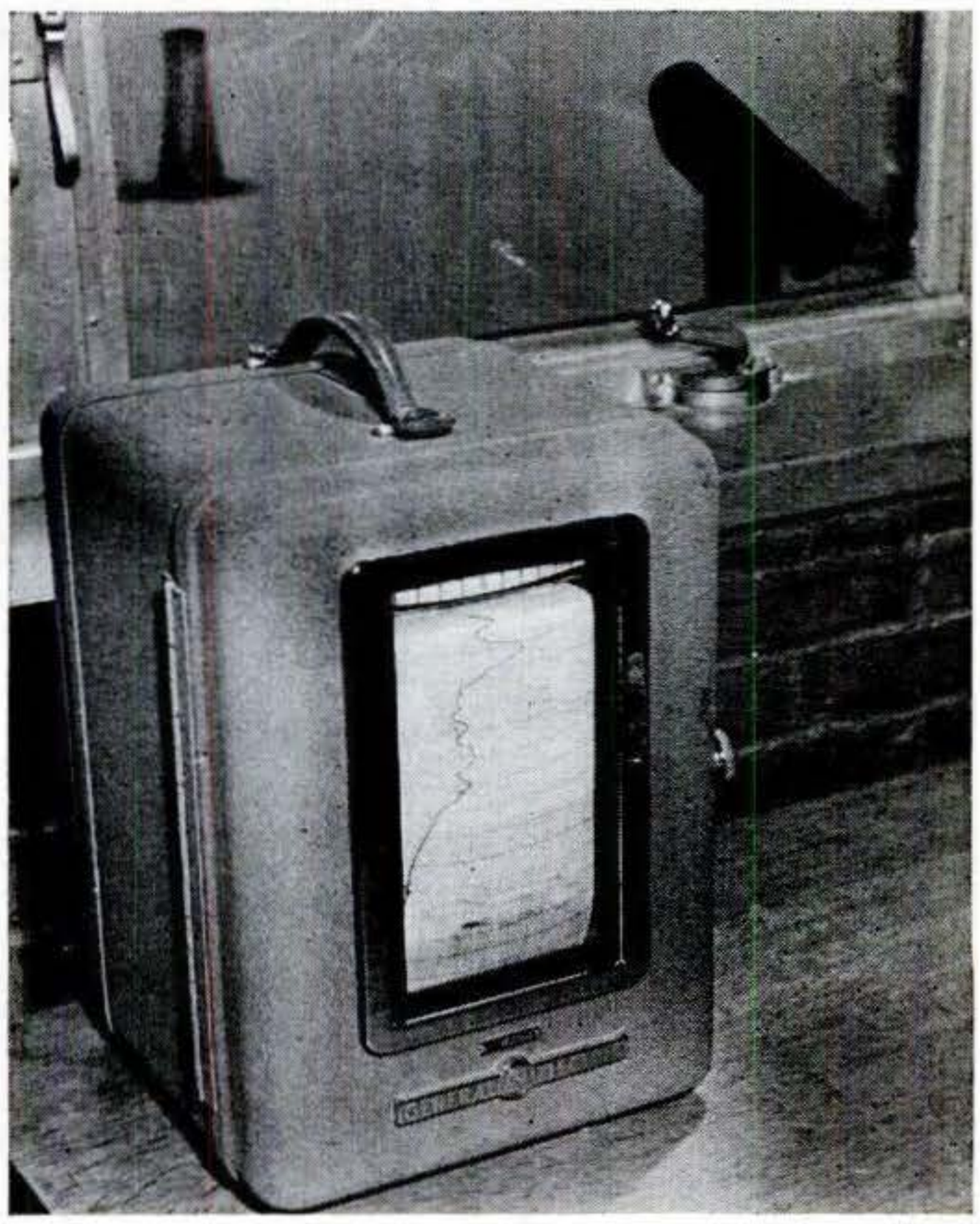
Dry ice does it by chilling parts of a cloud so much that ice-crystal seeds are formed. They then serve as natural nuclei. Silver iodide is one of the best of the "dusts" that act as nuclei. Water vapor freezes right around it.

### *Triggering: Debatable Secret*

This triggering action—whether it is started by dry ice or a chemical like silver iodide—is the fundamental "secret" of creating rain. It explains why only a few ounces of dry ice or silver iodide can cause rain over a tremendous area if conditions are right. Yet it also represents the basis of this scientific spat. The Weather Bureau says, "We have looked hard for evidence of a triggering action. But we've never found any."

How or when the controversy will be settled no one knows. Most likely, it will be decided by a lengthy series of carefully controlled tests. A bill now before Congress would provide money for such trials.

Until then lots of people are going to seed clouds. And it will rain. END



**Automatic cloud recorder** has photo cell (upper right) pointed at sky to measure brightness. From a day's chart, scientists can tell the number and types of clouds that were in the sky.



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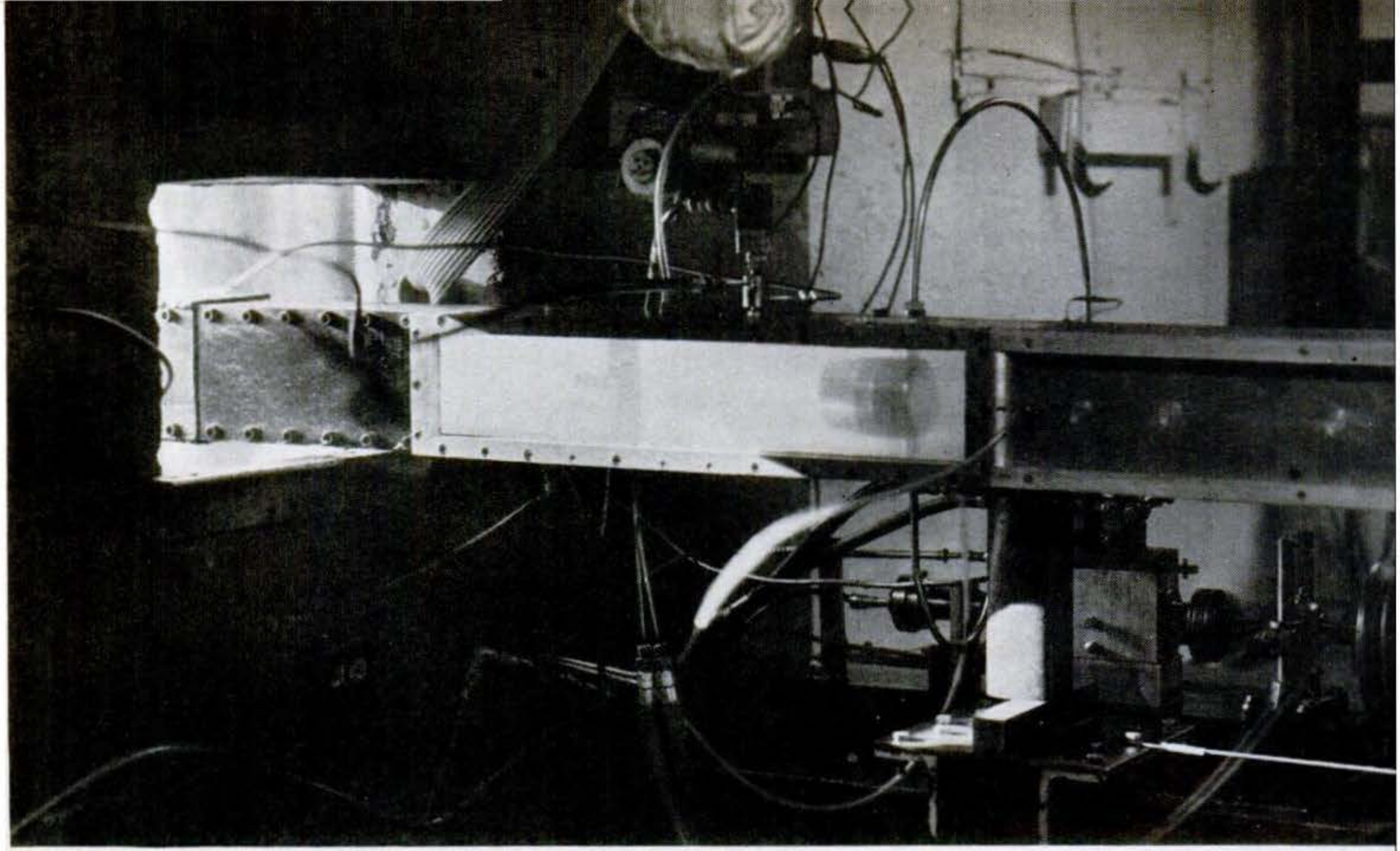


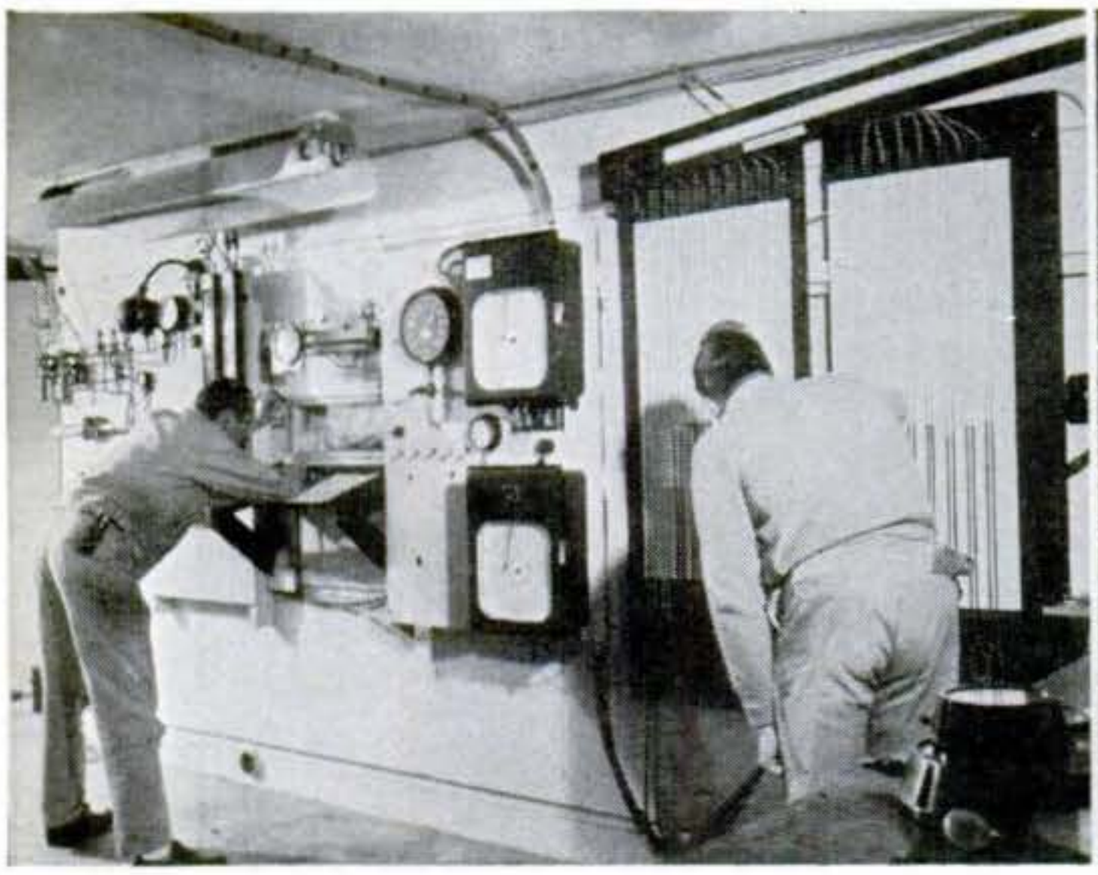
**An intermittent ram jet firing in its test cell at Princeton University's aeronautical lab.**

# Fooling the Jets for More Speed

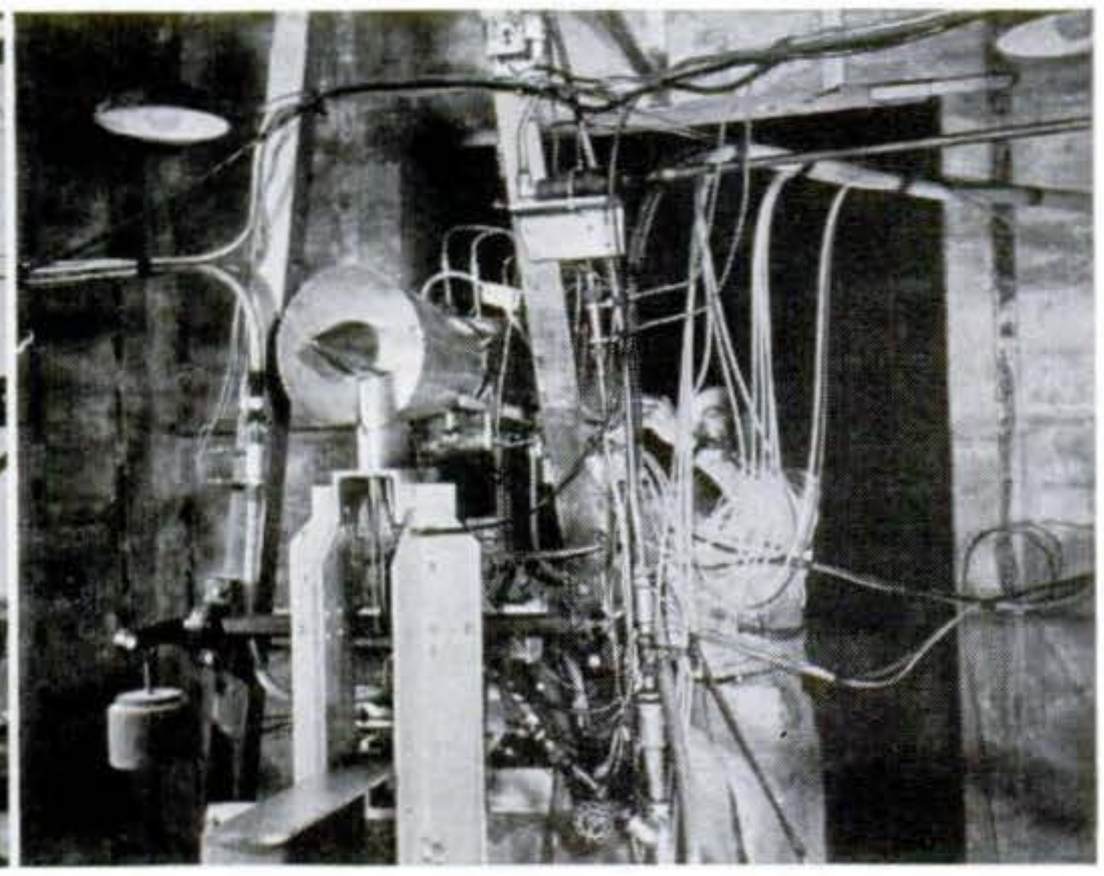
***By George H. Waltz, Jr.***

BY FOOLING today's jet engines into "thinking" they're doing things that they aren't, aeronautical experts are hatching out new jet power-plant designs for the planes of tomorrow. The results of their mechanical trickery, engineers hope, will be simpler jets that not only will rank very high in the speed range, but also high on the miles-per-gallon scale.

Two such experimental engines now are being studied at Princeton University's aeronautical laboratories in central New Jersey, as part of a broad jet-research program called Project SQUID, sponsored by the Offices of Naval Research of the Navy and of Air Research of the Air Force.



**Rocket man** watches operation, through periscope, of new rocket-ram engine, which is mounted in test cell behind thick concrete wall. Gauges at right measure jet's performance.



**Adjusting rocket-ram model** before making a test run. The small rocket that's used to make the ramjet "think" it is going fast enough to work shows at end of the ram tube.



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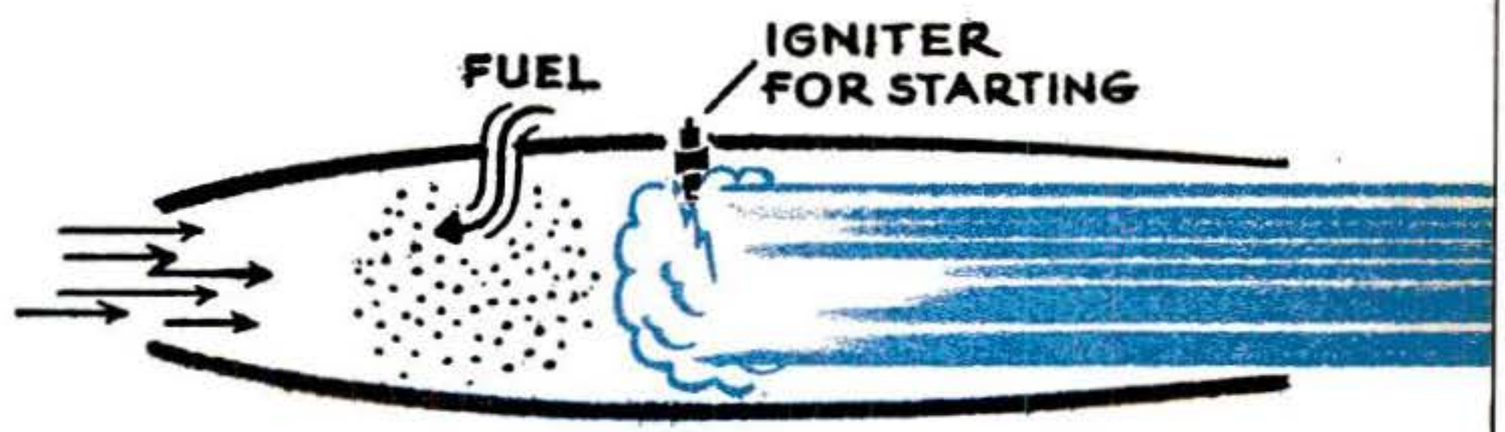
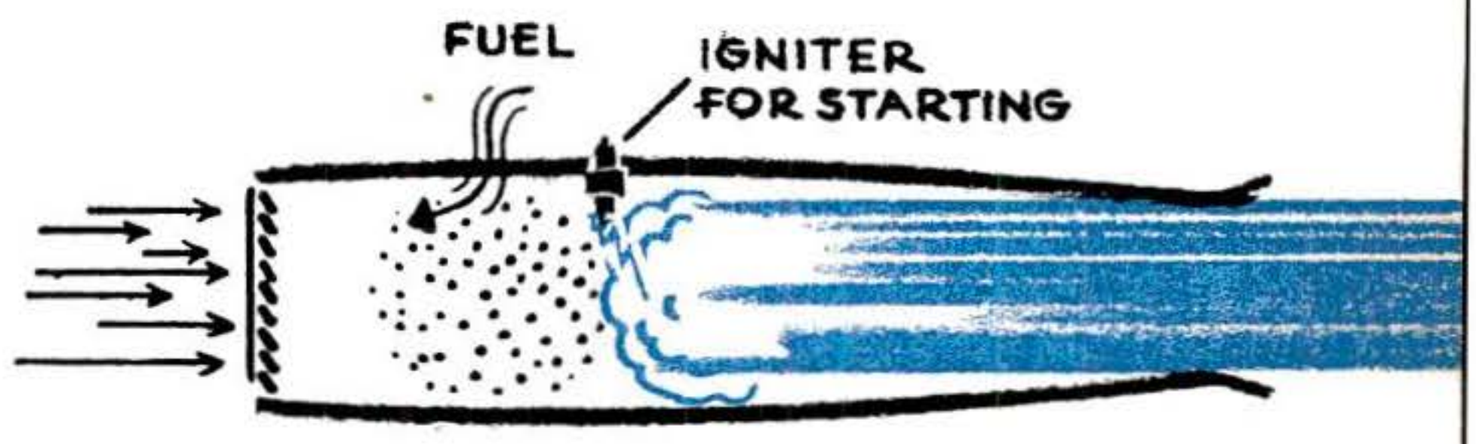
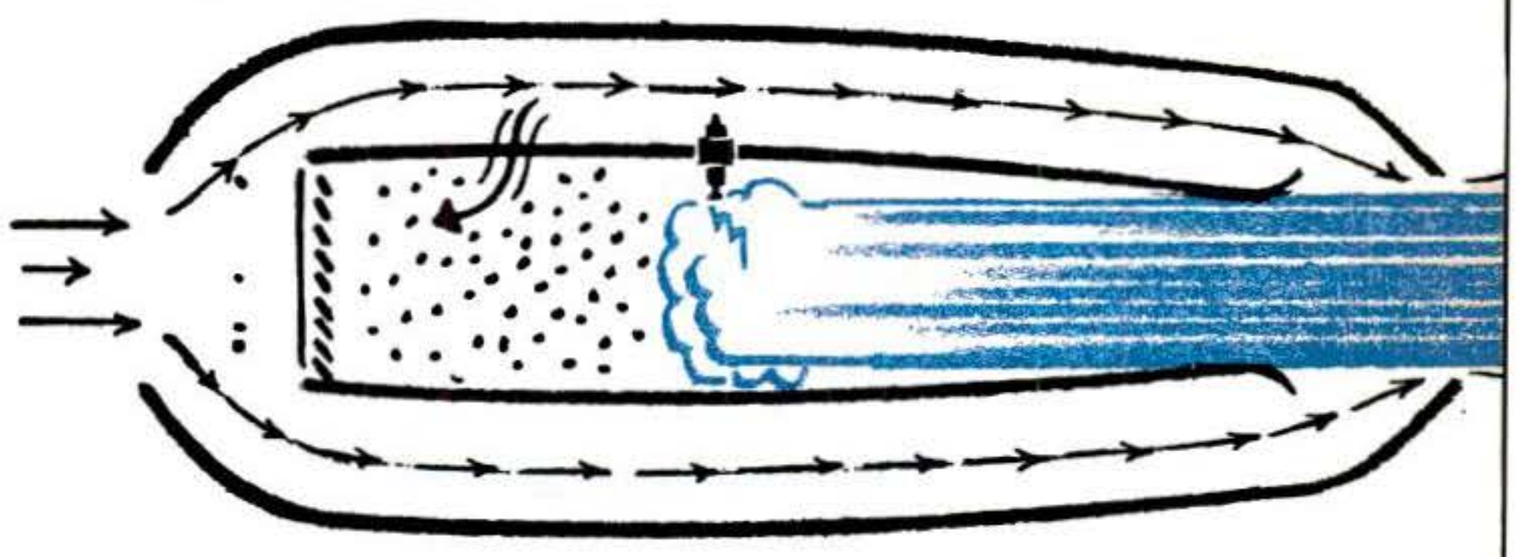
**1 Ram jet.** The ram jet is the simplest of jet engines. It is literally nothing more than a tube with a fire in it. Air rushing in front end mixes with continuously injected fuel, compresses, and burns to provide usable forward thrust.



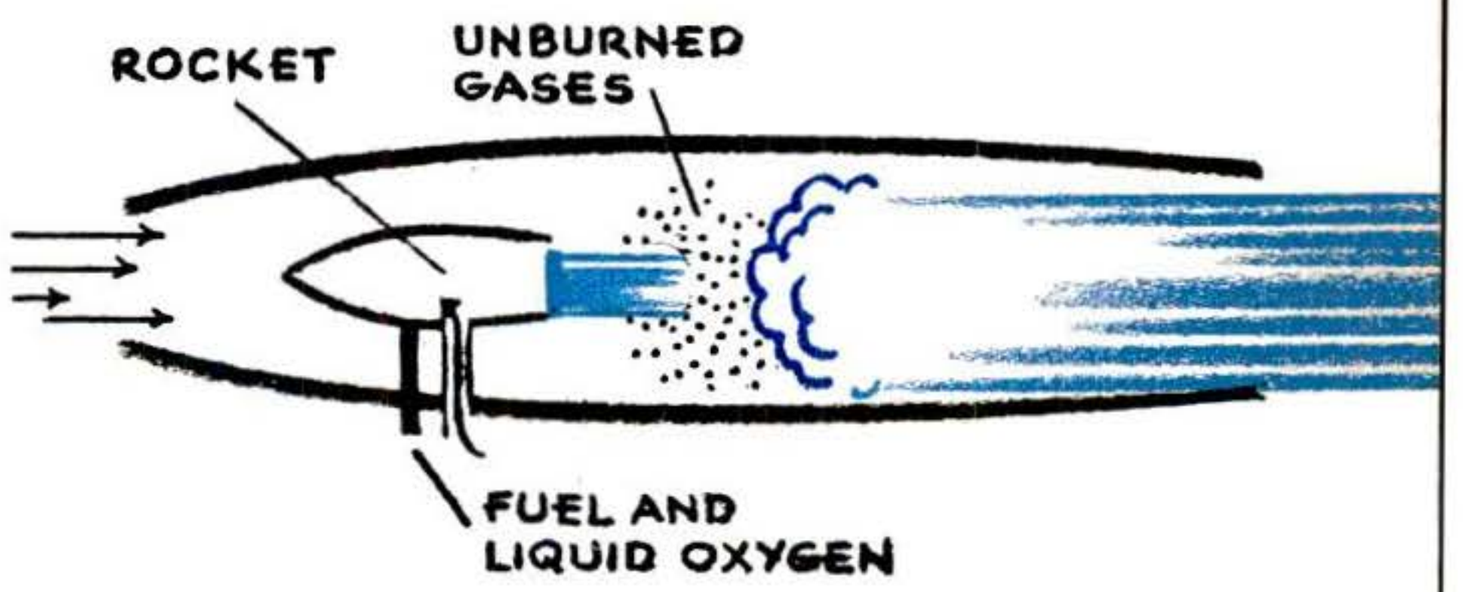

**2 Pulse jet.** The pulse jet, the engine used to power the German V-1 flying bombs, has an automatic, shutterlike valve at its forward end. Shutters let air in, are closed by pressure of combustion of air-fuel mixture, then are forced open again by inrushing air. While ram jet fires continuously, pulse jet fires intermittently.



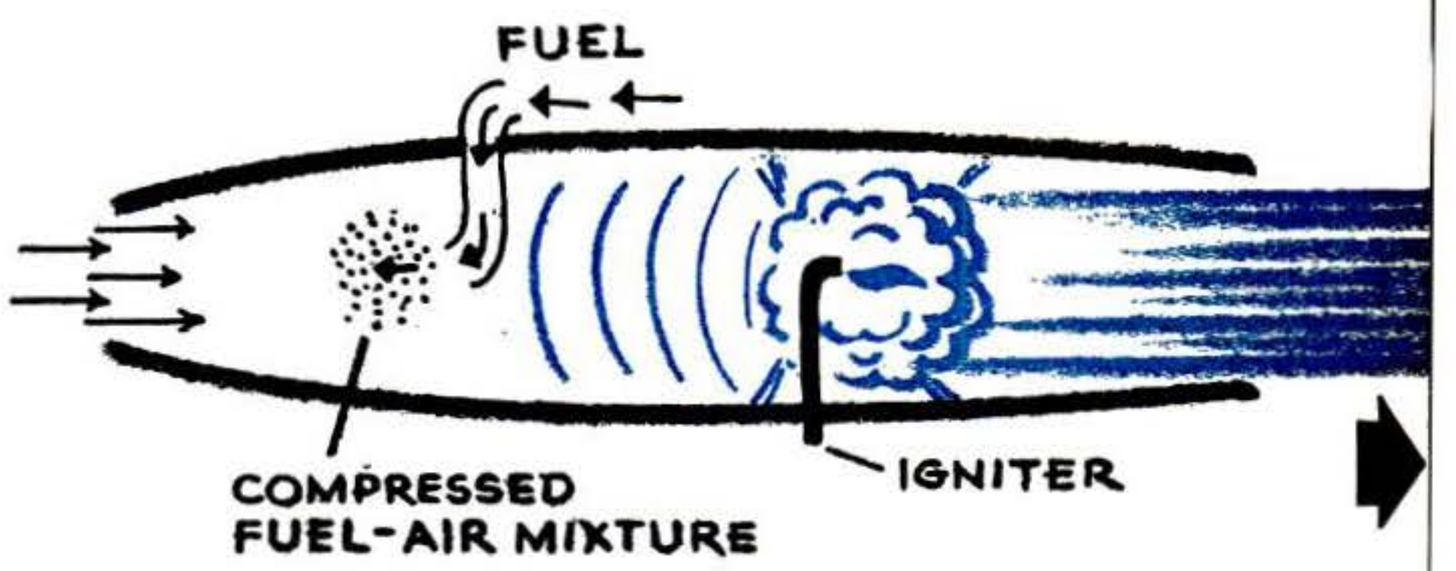

**3 Shrouded pulse jet.** Because the blunt forward end of a pulse jet creates a drag, its top speed is limited. A shroud placed around a pulse jet, however, allows air to expand and slow down so that air surrounding pulse-jet valve does not reach critical speed at which drag overcomes thrust, even at high forward speed.



**4 Rocket ram.** One big disadvantage of both the ram and pulse jet is that they require initial velocity and therefor must be launched. Rocket placed in ram, however, not only provides ram with fuel in the form of unburned gases but sucks air into ram's front so that high initial speed is unnecessary —it can start itself.




**5 Intermittent ram jet.** This acts like pulse jet, but has no drag-producing shutter valve. Instead, fuel is injected into a ram engine in rapid-fire slugs. Each fuel charge mixes with incoming air, moves down tube, and explodes as it reaches igniter. Explosion not only provide rearward thrust, but also compresses next fuel-air charge.



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Because the ramjet is the simplest of all jet power plants, SQUID's scientists have directed a good portion of their research toward it. Often referred to as "the flying stovepipe with a fire in it," the ramjet literally is just that. Pushing through the air at tremendous speeds, the front, open end of the engine scoops in air which, by its own force, compresses itself, mixes with the continuously injected liquid fuel, and burns. The expanding gases shooting from the rear of the tube provide the forward thrust. The faster a ramjet goes, the faster it can theoretically go.

### *No Self-Starter*

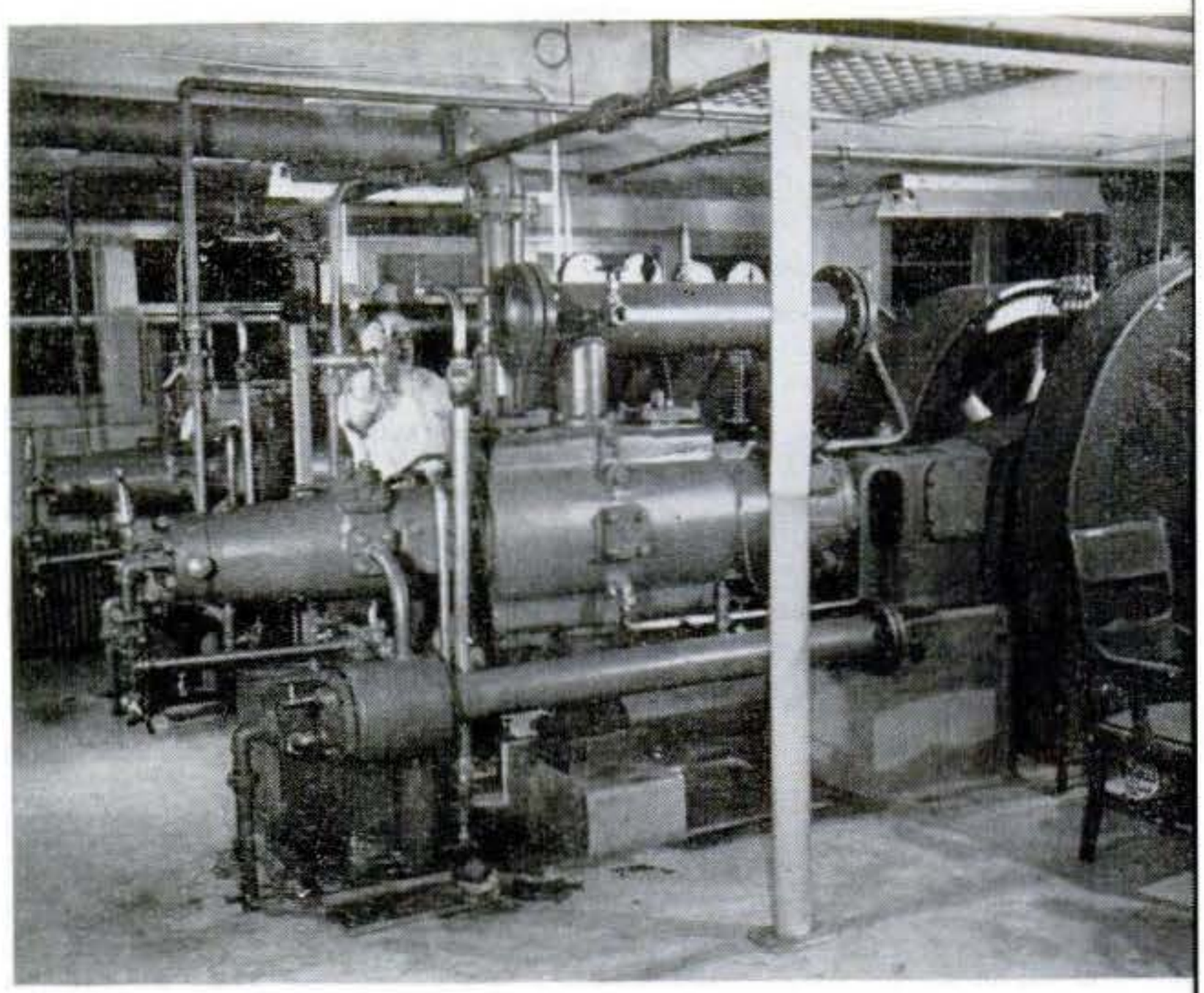
The ram, however, has one serious drawback—it has to be moving through the air at about 500 m.p.h. before it will even begin to operate. It takes that speed for it to gulp in enough air, fast enough. For this reason, guided missiles powered by rams must be brought up to their high operating velocity by some other power source. For the same reason, ramjets can be used on aircraft only as auxiliary power plants (PS, Jan. '49, p. 130). They cannot be used for take-offs.

SQUID men at Princeton, however, have succeeded in making a ramjet engine "think" it is going fast enough to operate even when it is standing still. They have tricked an experimental ram into firing and providing thrust at zero velocity, opening the way for ramjet-powered take-offs.

The trick is accomplished by mounting a small fuel-and-liquid-oxygen rocket just inside the forward end of the ram engine. Like all rockets, the rocket in the ram does not burn all of the combustibles in its fuel. Carbon monoxide and hydrogen, among other gases, remain in the tail exhaust. These form ideal fuels for a ramjet.

Furthermore, as the rocket inside burns, the rush of the burning fuel sucks air into the front end of the ram in tremendous quantities and at high speed. As far as the ramjet engine is concerned, it is getting all the things it needs to operate—high-speed air, fuel in the form of carbon monoxide and hydrogen, and an igniter—so it fires and produces usable thrust. SQUID's "flying stovepipe," aided by a small built-in rocket, may very well lead the way to the airplane engine of tomorrow.

Not far from Princeton's rocket-ram test room, another group of SQUID's engineers are using mechanical trickery to fool another ramjet engine into "thinking" it is a pulse jet in order to gain greater fuel economy. The pulse jet—the easily built engine used to power the German V-1s—has better fuel economy than the ramjet, but it also has a relatively low top speed. Because its blunt front end must be closed off with a shutterlike valve that opens and closes automatically to let in the air, its drag increases rapidly with its speed. Around 450 m.p.h., the drag just about equals the available thrust and the engine no longer accelerates.



**Two powerful compressors** provide the air for Princeton's new supersonic wind tunnel capable of providing speeds as high as 3,500 m.p.h. and altitudes from sea level to 100,000 ft.

### *Shutterless Pulse Jet*

To get around this difficulty, Princeton's jet experts have built a test model of a new kind of jet engine—the intermittent ramjet. Basically, the new engine is a first cousin of the ramjet. It consists simply of a tube open at both ends. The main difference between it and the ramjet is in the combustion process. In the ramjet, fuel is injected into the engine in a steady stream, and the combustion of the air-fuel mixture is continuous and takes place at a relatively constant pressure.

In the intermittent ram, however, the fuel is squirted into the engine in individual, rapid-fire slugs. As a result, the combustion is explosive and intermittent, with a rise in pressure with every explosion that serves to compress the following charge of air and fuel. In effect, the intermittent ramjet operates more like the pulse jet than the ram-



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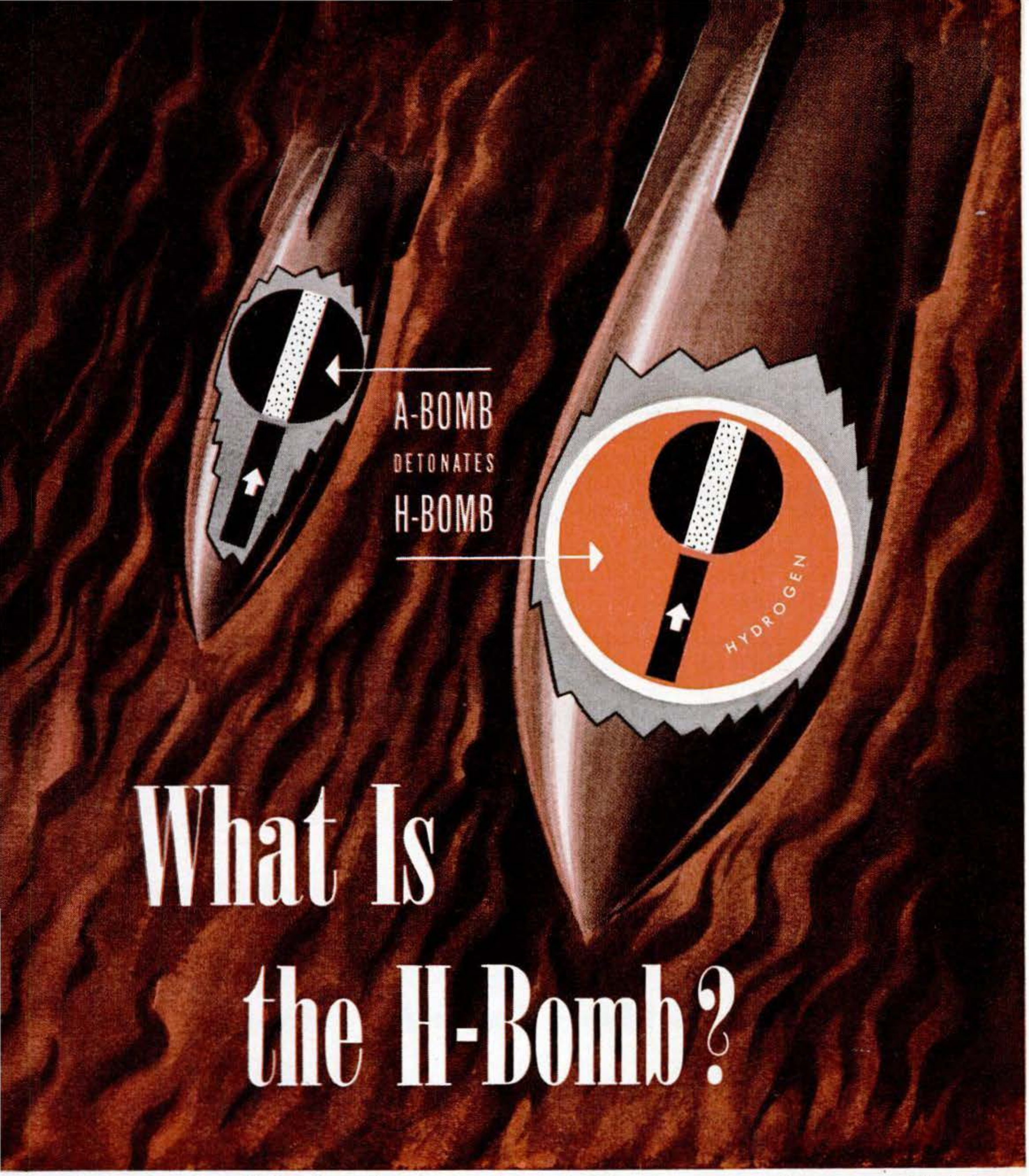


# What Is the H-Bomb?

**Artist visualizes H-bomb,** right, compared to A-bomb. Gunlike mechanism sets off A-bomb by firing "bullet" of fissionable uranium or plutonium into larger mass of same material. A-bomb itself would serve as detonator for H-bomb with suitable form of hydrogen as explosive charge.

***By Alden P. Armagnac*** *Drawings by Ray Pioch*

PRODUCTION of the hydrogen atomic bomb has been ordered by the President of the United States. Within one to three years, it is unofficially predicted, the first of the most awesome military weapons ever built may be ready for test. Leading scientists say they hope it won't work—but are "afraid it will."

A uranium or plutonium bomb, the "A-bomb" that wiped out Hiroshima and Nagasaki, merely serves as a detonator for the superbomb that is planned. At the resulting temperature of millions of degrees, a type of atomic reaction will take place that is new on earth. A process called "fusion," the opposite of "fission," will



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give the bomb from eight to 1,000 times the power of the A-bomb.

That an H-bomb could be built was foreseen by physicists even before the discovery of uranium fission. Atomic reactions of the fusion type supply the energy of the sun and of stars. Their duplication on earth awaited only a means of attaining comparable temperature and pressure, which the A-bomb now provides, to start the reaction.

Peaceful uses of the superbomb's reaction appear impossible, because of the cataclysm required to bring it about. Unlike uranium fission with its promise of untold power for constructive ends, hydrogen fusion seems adaptable to military purposes alone, in an instrument of destruction beyond all limits known before.

### *Figures Show What An H-Bomb Can Do*

The scale of a hydrogen bomb's devastation can be readily calculated. It may surprise some laymen to learn that it takes an enormous increase in a bomb's power to extend its destructive range only a little. By a simple "cube-root" formula commonly employed, multiplying a bomb's power eight times will just double its radius of destruction. A multiplication in power of 1,000 times will increase the destructive radius 10-fold. Observations of actual explosions indicate these figures are ultraconservative estimates of destructive range.

An H-bomb eight to 1,000 times as powerful as an A-bomb would therefore produce the same effects at a distance *at least* two to 10 times as great, respectively. From the known performance of the A-bomb, these can be visualized as follows:

Explosion of an H-bomb of eight times the A-bomb's power would create a ball of fire two-thirds of a mile in diameter—a miniature star in mid-air, far above the earth for maximum effectiveness. From its center would radiate explosive blast, searing heat, and deadly radioactive rays.

Up to a radius of one mile from the point on earth beneath the explosion, nearly all persons would perish. Many would be killed three times over, by blast, heat, and radioactivity. Nothing but seared rubble would remain of most buildings. Any left standing would be gutted by fire.

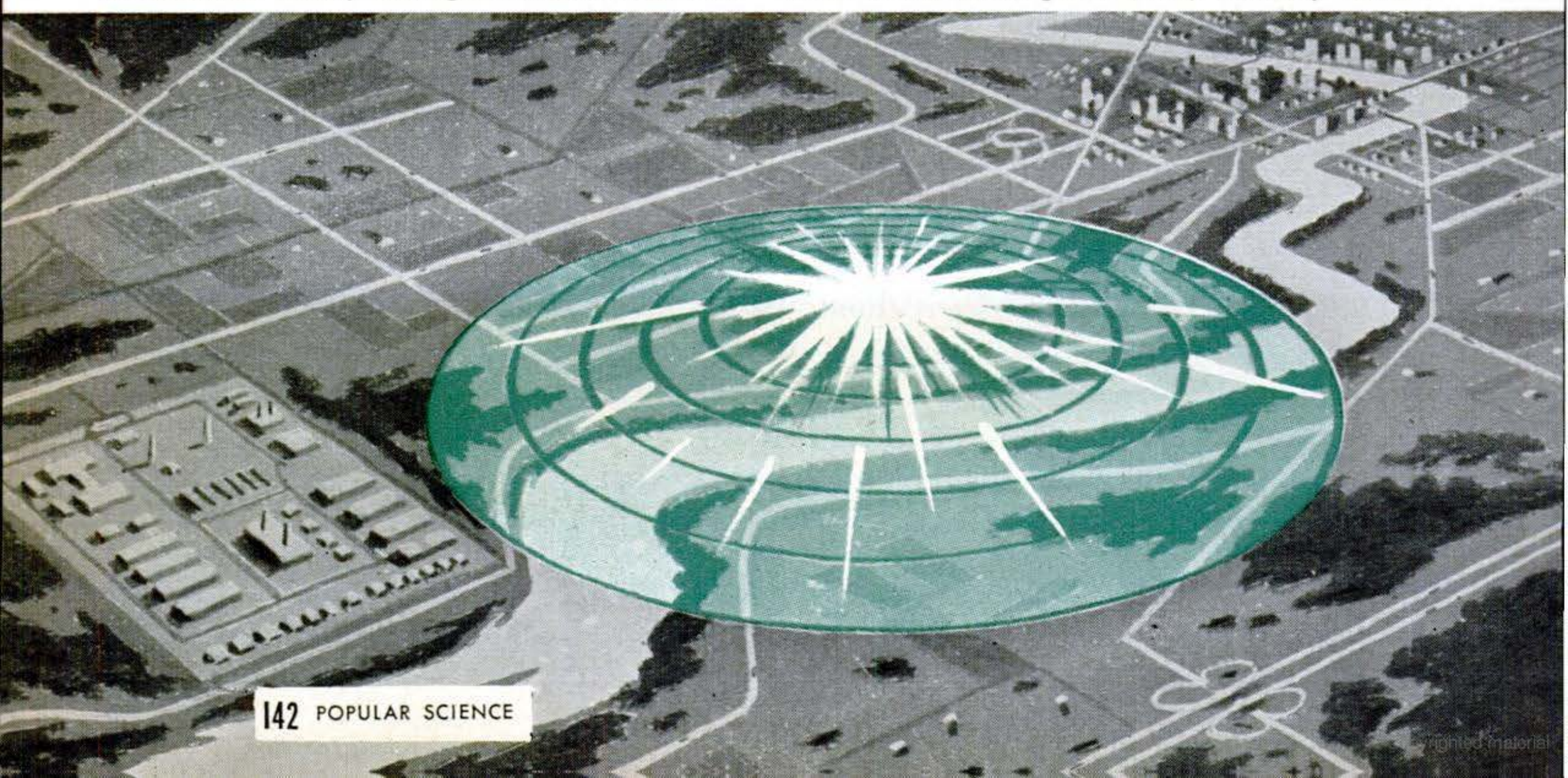
Between one- and two-mile radii, casualties would be enormous from flying, falling, and burning debris and from flash burns caused by the bomb's radiant heat. Steel buildings would be twisted and brick buildings shattered by blast.

Beyond the two-mile radius most casualties would be nonfatal flash burns. Mild ones might be inflicted more than four miles away.

Scaling up the power of the H-bomb to 1,000 times that of the A-bomb would extend the central zone of total destruction to a circle of five-mile radius. Heavy casual-

## *Turning Near-Miss into Hit Is Prime*

**A-bomb,** exploded at most effective height of 2,000 feet, causes total destruction up to half-mile radius. Heavy damage extends to one-mile radius, indicated by colored area below. With enemy atomic plant as imaginary target, near-miss would leave plant (left) virtually intact.



ties and damage would occur up to ten-mile radius and injuries would extend far beyond. From the A-bomb to a bomb of such fantastic power, capable of obliterating an area of at least 75 square miles and laying waste a zone four times as great, would be a step as far as from the "blockbuster" to the atomic bomb itself.

### *What H-Bombs Mean to Military Strategy*

Obviously a city as large as New York—which Lt. Gen. Leslie R. Groves has estimated it would take seven A-bombs to destroy—could be wiped out instantly by a single medium-sized hydrogen bomb. With an H-bomb in enemy hands, this and some of the other largest American cities could hardly fail to be tempting targets. In other lands, comparable targets are scarcer. Russia, largest country on earth, has only two really large cities: Moscow and Leningrad.

Except for an enemy city or two, then, and perhaps a naval fleet widely dispersed at sea, what target can possibly be imagined for made-in-America H-bombs, where an A-bomb would not accomplish as much?

If bomb hits were always bull's-eyes, the answer might well be: none. But the best bombardier with the best bombsight cannot guarantee to hit a target—say, an enemy's atom-bomb plant—that may be vigorously defended, or masked by unfavorable weather. And far wider misses are likely if atomic bombs are to be delivered by long-range pilotless missiles.

**COMPARATIVE EFFECT OF A-BOMB AND H-BOMB**

| TYPE OF BOMB | | ZONE OF TOTAL DESTRUCTION (Nearly all persons killed, buildings razed) | ZONE OF HEAVY DAMAGE (Casualties high, buildings severely damaged) |
|---|---|---|---|
| A-BOMB | RADIUS | ½ MILE | 1 MILE |
| | AREA | ¾ SQ. MILE | 3 SQ. MILES |
| H-BOMB 8 Times as Powerful | RADIUS | 1 MILE | 2 MILES |
| | AREA | 3 SQ. MILES | 12 SQ. MILES |
| H-BOMB 1,000 Times as Powerful | RADIUS | 5 MILES | 10 MILES |
| | AREA | 75 SQ. MILES (approx.) | 300 SQ. MILES (approx.) |

Ability to turn a "near-miss" into an effective hit therefore sums up the outstanding advantage of the H-bomb over the A-bomb as a military weapon.

### *Unlimited Size Explains the H-Bomb's Power*

What accounts for the H-bomb's enormous capacity for destruction?

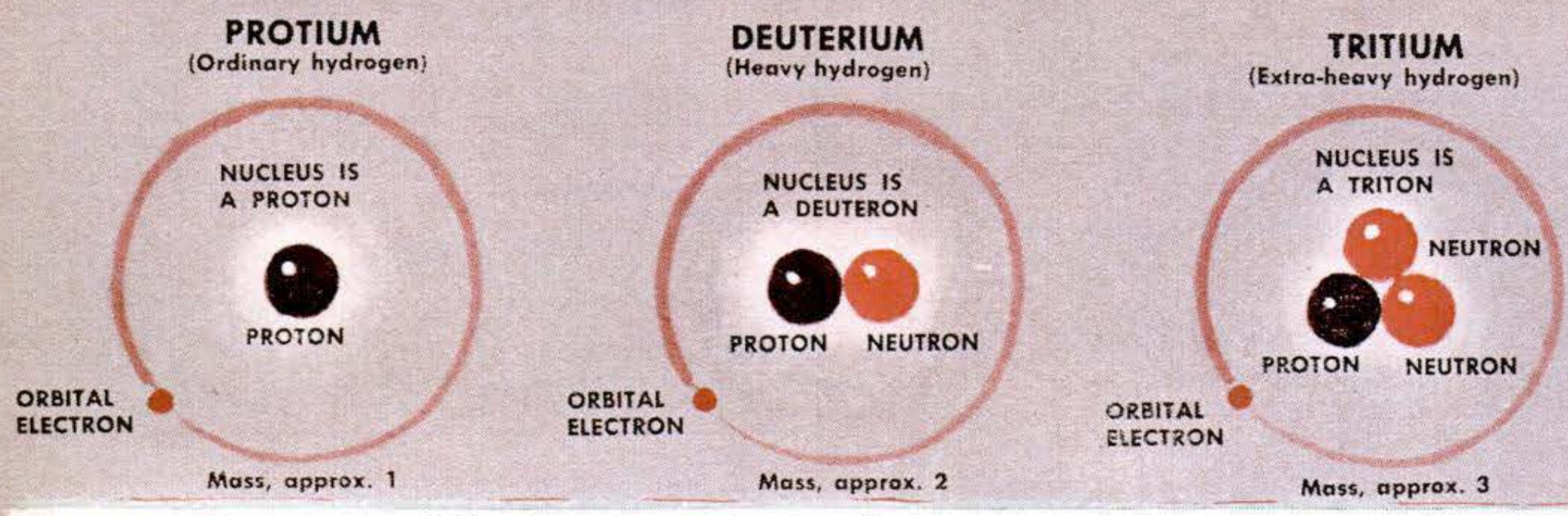
Some of the different atomic-fusion reactions that it could employ give several times the power that uranium does, weight for weight of ingredients. But that is only a small part of the story.

*Unlimited size is the real secret of the H-bomb's staggering power.* Size of ➧

## *Military Advantage of the H-Bomb*

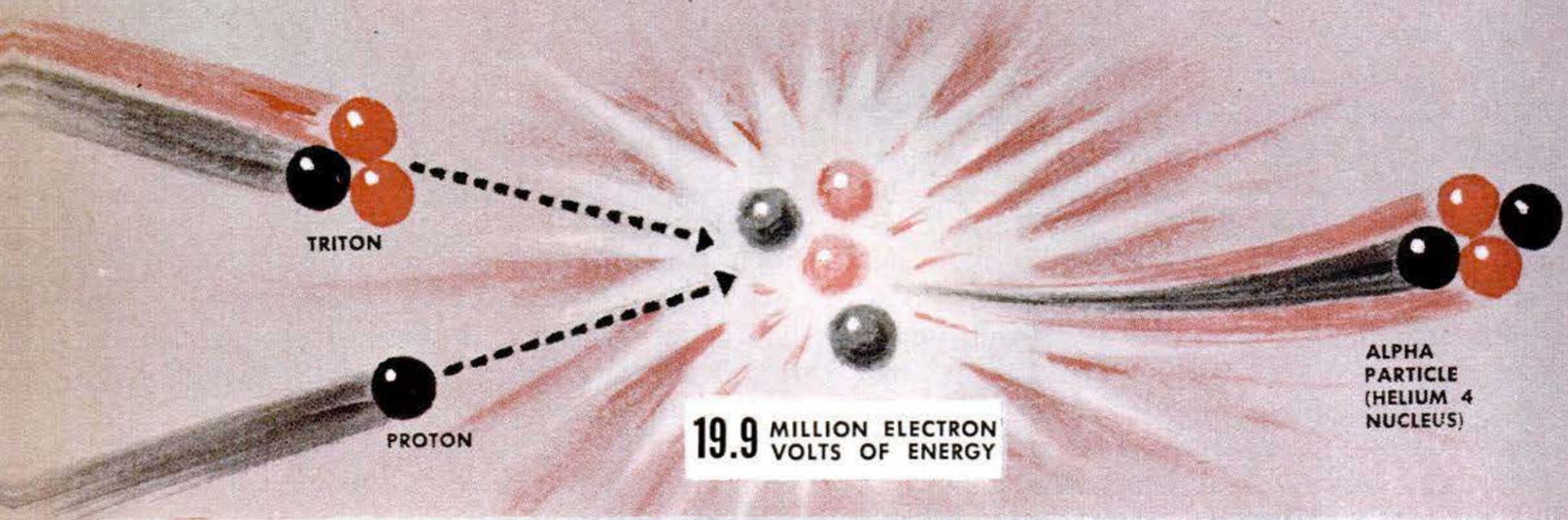
**H-bomb** turns near-miss into hit. Minimum estimate of power, eight times A-bomb's, makes range of total destruction one mile. Area of heavy damage, in color, has two-mile radius and includes target. H-bomb 64 times A-bomb's power totally destroys this area and target.

# H-Bomb May Use Rare Kind of Hydrogen

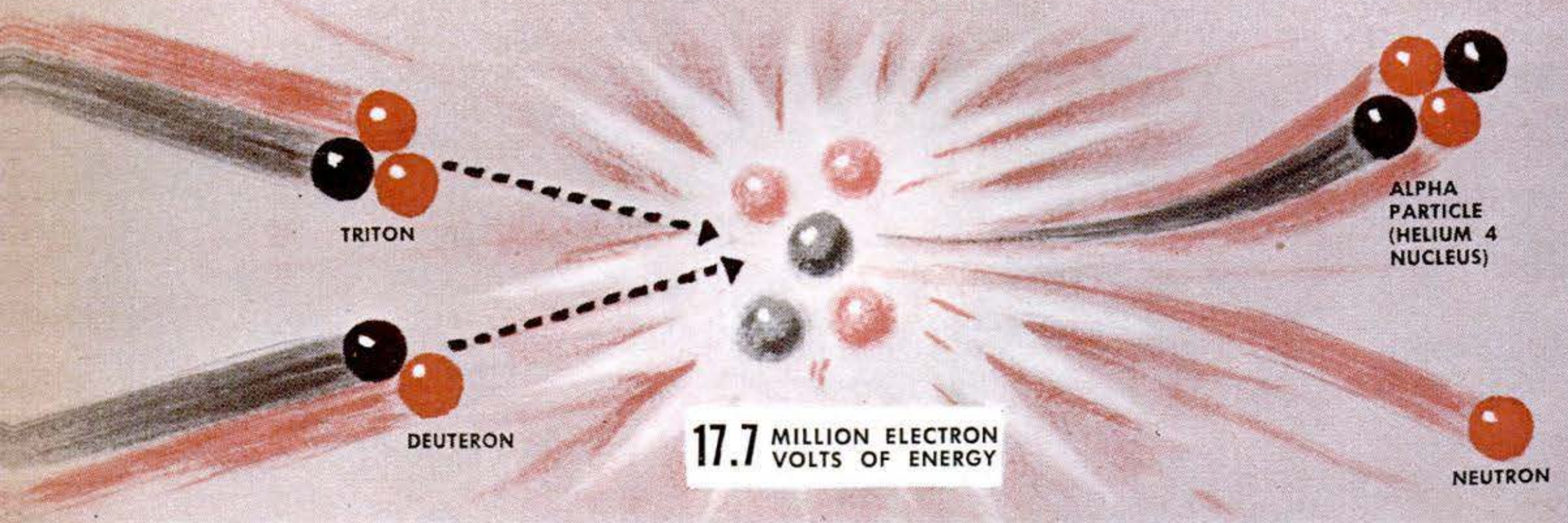



**Pictures show atoms** of the three known kinds of hydrogen, all gases. H-bomb might use one or more of these. Favorite guess is tritium, rare extra-heavy variety, currently made from lithium by neutrons of Argonne atomic pile. Deuterium is the hydrogen in heavy water. Bomb heat strips atoms of their orbital electrons, and bare nuclei, "atoms in the raw," react as shown below.

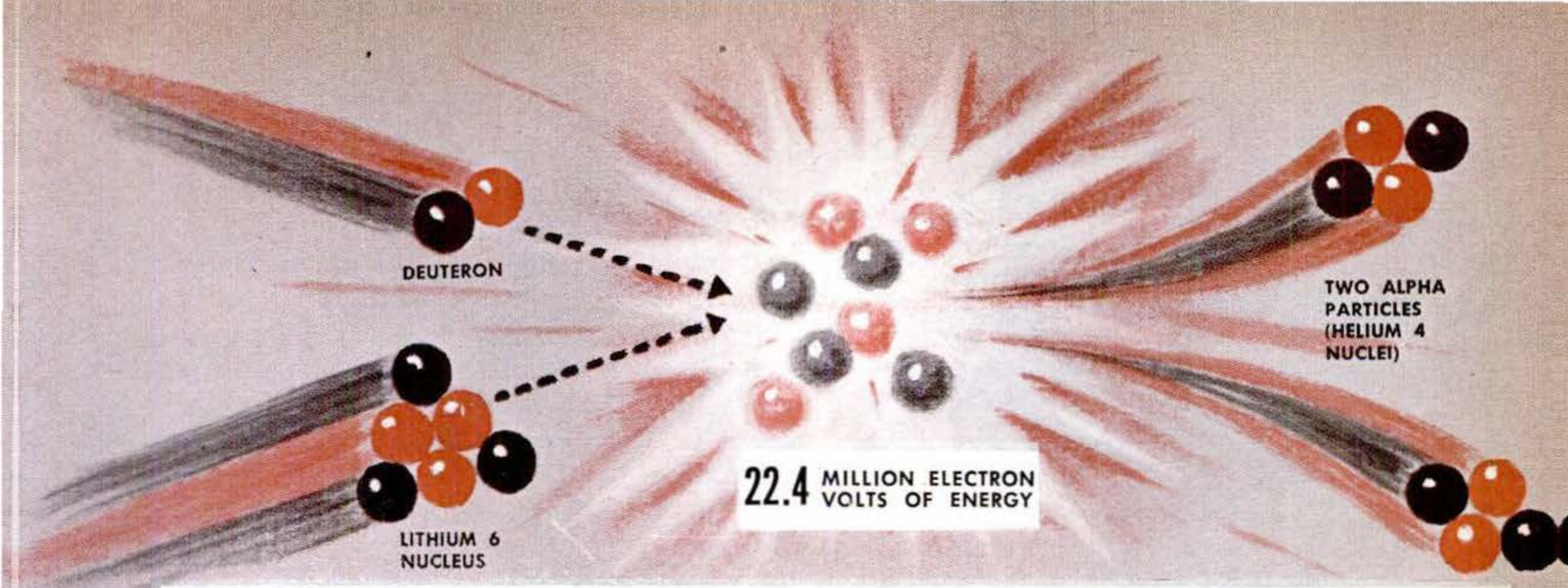
# Fusion of Light Atoms Powers the H-Bomb



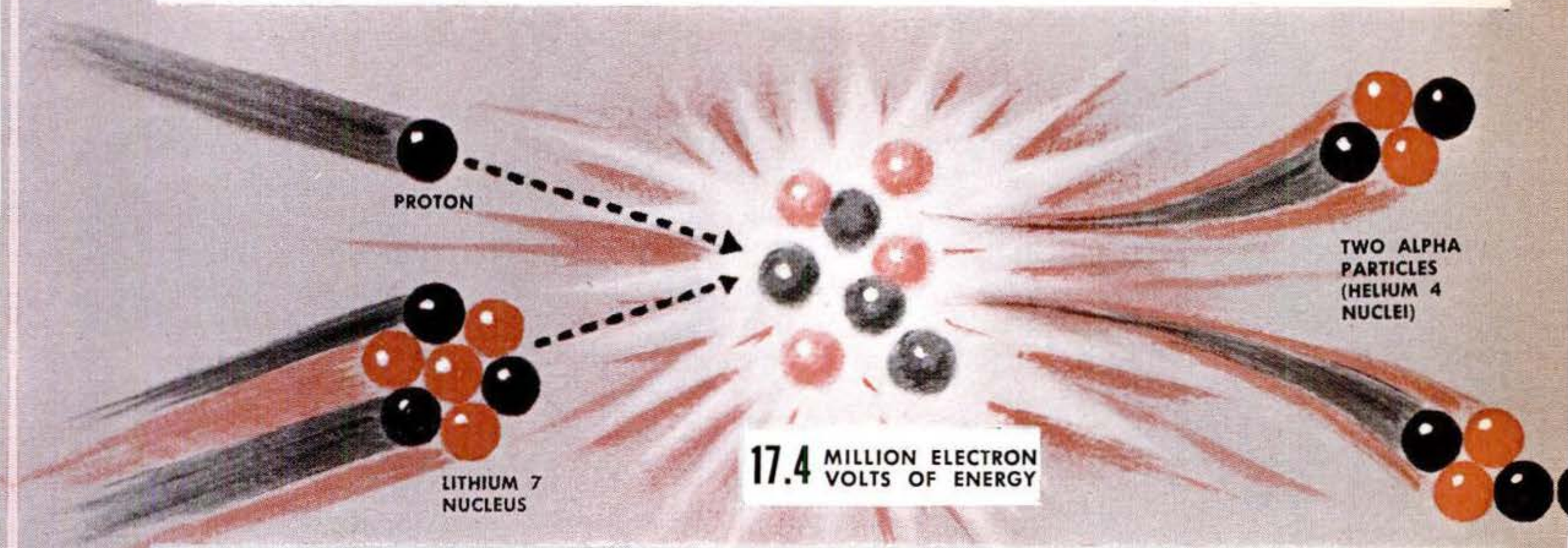

**H-bomb makers** have choice of reactions that build up hydrogen of all kinds into helium, loosing known amounts of energy. Figures favor tritium. Fusion of a tritium nucleus with a proton, above, yields a helium nucleus and whopping 19.9 million electron volts of energy. This would give H-bomb six times the power of uranium or plutonium bomb of same weight.




**Fusion of a triton** with a deuteron gives 17.7 million electron volts, and H-bomb four times as powerful as equal-weight uranium type. Alternatively, it could use energy of deuteron-deuteron or proton-deuteron fusion. Since ordinary hydrogen absorbs neutrons, needed in uranium chain reaction that detonates H-bombs, choice might favor reactions using other kinds.

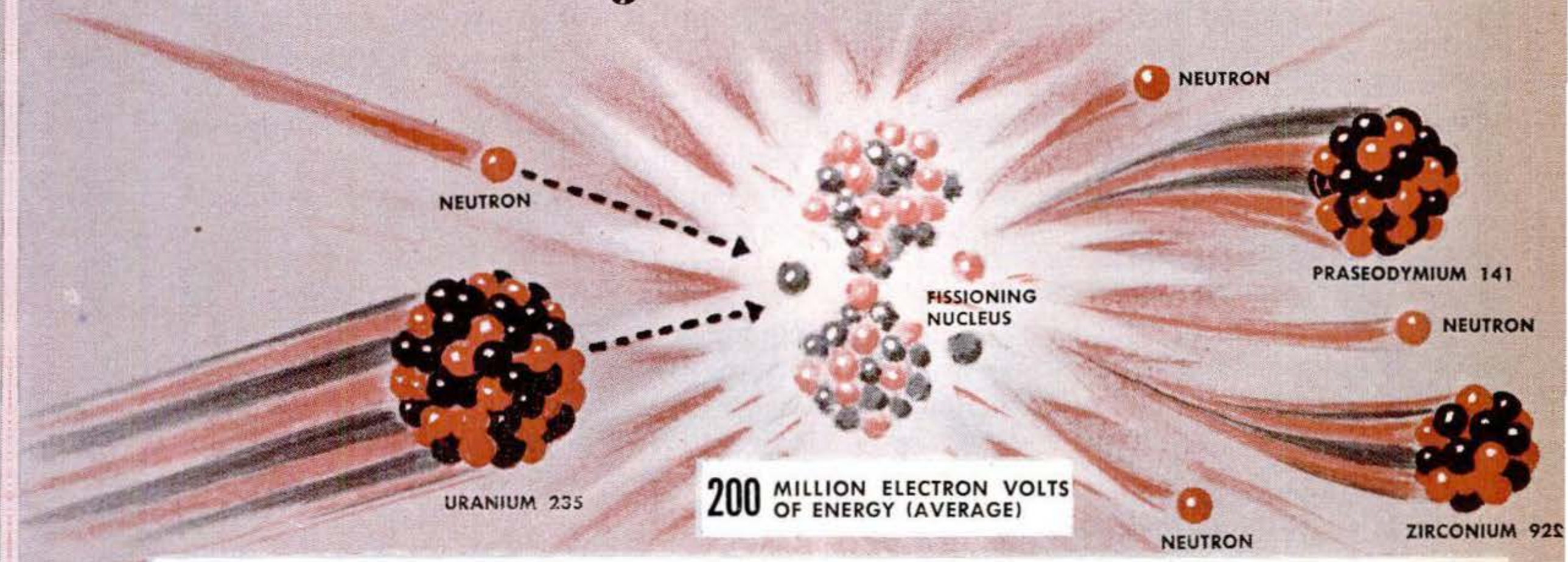



**Light element lithium** could be additional H-bomb ingredient. Two natural kinds, lithium 6 and 7, are abundant. They now are separated electromagnetically at Oak Ridge and available in pure form. Lithium-6 nucleus fuses with deuteron, above, to yield two helium nuclei, 22.4 million electron volts of energy, and, weight for weight, 3¼ times power of uranium.

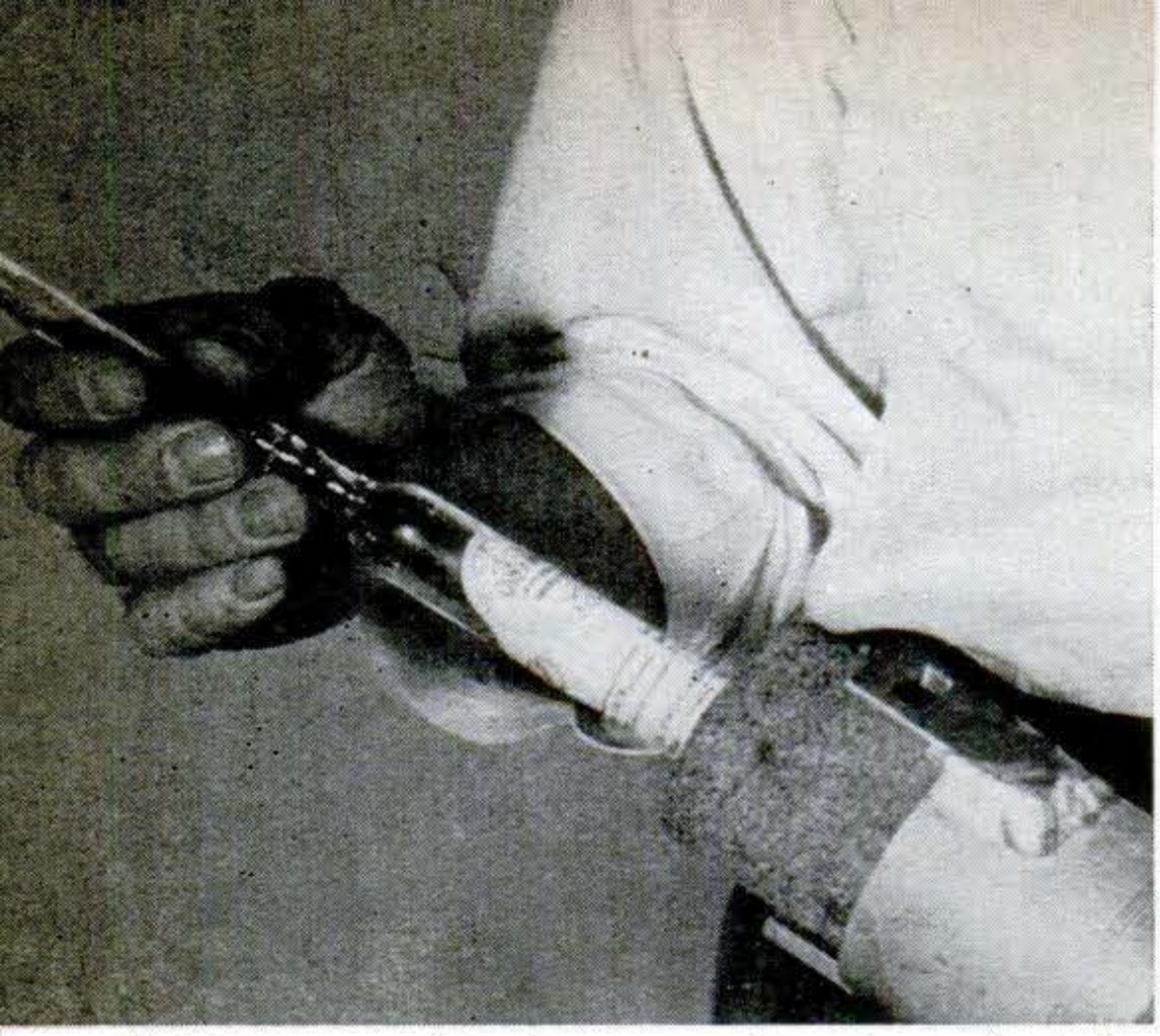



**First transmutation** of an element with artificially accelerated particles was by this historic 1932 reaction, another that a lithium-hydrogen bomb could use. It yields 2½ times power of same weight of uranium. Bomb could contain lithium and hydrogen of any kind in form of a single chemical compound of them—lithium hydride, a gray-blue-to-white crystalline solid.

## *Fission of Heavy Atoms Powers the A-Bomb*




**Uranium or plutonium** yields energy when big nucleus breaks in two, after hit by neutron. Here is typical pair of many uranium-fission products. Average energy of uranium fissions—200 million electron volts—appears to be much bigger than that of hydrogen fusion. But energy *per pound* of hydrogen fusion is far greater because the materials are so much lighter than uranium.



**Tritium gas** in glass container is packed for shipment at Argonne National Laboratory, where this rare form of hydrogen is made by artificial transmutation of lithium in atomic pile.

the A-bomb is restricted by the "critical" amount of uranium 235 or plutonium 239 that explodes spontaneously when brought together—an amount officially described as somewhere between 4.4 and 220 pounds. But the H-bomb's fusion-type reaction does not start spontaneously. There is no "critical" amount of its explosive. Hence the H-bomb can be of prodigious size.

Even a whole ship could be made an H-bomb—by loading it with the ingredients, and sailing it as a floating mine into an enemy harbor.

Only limit to the bulk of an airborne H-bomb is the size of the biggest bomb a plane can carry. This size can be gauged by the largest U. S. Air Force bomb for which figures are publicly available—a gigantic 21-ton "general-purpose" type containing conventional explosive, first tested in 1948 at the Muroc, Calif., bombing range. (A B-36 carried the heaviest bomb load ever flown, 84,000 pounds, when it dropped two of those bombs.)

At the other extreme of the size scale, the first H-bomb or H-bombs built for test can be of "baby" size, little more powerful than an A-bomb. These could suffice to determine whether any particular H-bomb reaction would work. Several test bombs may be built and tried out at the same time, to compare different ingredients and reactions.

### *The Mechanics of the H-Bomb Reaction*

Just possibly, a fission chain reaction may have occurred on earth, before man invented the A-bomb, in some natural "atomic pile" where deposits of uranium and carbon were laid down together. But only in the sun and stars can an atomic-fusion reaction take place naturally.

At stellar temperature and pressure, nuclei of hydrogen atoms collide and fuse together. They turn into helium. This illustrates fusion reactions, in which light elements turn into heavier ones. It is just the opposite of uranium fission, in which a heavy atom breaks up into lighter ones, but in each case the total mass is slightly less after the reaction than before. Mass has vanished and turned into energy.

The mystery of the sun's boundless energy was solved in 1939 when Dr. H. A. Bethe of Cornell University found it came from hydrogen-to-helium atomic fusion. In the sun, the process is a roundabout one of six separate reactions.

Designers of an H-bomb have dozens of possible fusion reactions to choose from. They have been produced on a miniature scale, permitting their study, in the great atom-smashers of leading laboratories. Ruled out is the one occurring in the sun, which takes an average time of 6,000,000 years. The ones bomb-makers probably are interested in build hydrogen into helium in a single step, a split second, and a mighty burst of energy.

### *Tritium Could Supply H-Bomb's Energy*

Your dictionary will tell you that Triton is the name of a character in Greek mythology and that a triton is a sea shell, but "triton" has a new meaning today. It is the nucleus of a tritium or extra-heavy-hydrogen atom, and recently discovered triton reactions are among the most powerful of all. That explains why tritium is linked to the H-bomb in speculation. Lithium-hydrogen reactions also yield great power.

Examples of these reactions, seemingly promising for an H-bomb, are illustrated on the two preceding pages. The bomb would need to contain a mixture of the ingredients of the chosen reaction. Thus for the triton-proton reaction, it would use a mixture of tritium and ordinary hydrogen; for the triton-deuteron reaction, a mixture of tritium and deuterium (heavy hydrogen).

Other possible choices include what physicists call the "D-D reactions," in which two deuterons unite. This yields a triton and a proton, or a helium-3 nucleus and a neutron, and considerable energy in either



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case. A bomb using this reaction could contain heavy hydrogen alone, in the form of heavy water, for example.

### *Specifications of an Imaginary H-Bomb*

Only those entrusted with the nation's top secrets know the details of the H-bomb design. Any description of its appearance and materials must therefore be purest speculation. Here are imaginary specifications for an airborne H-bomb, based on a variety of sources, all publicly available:

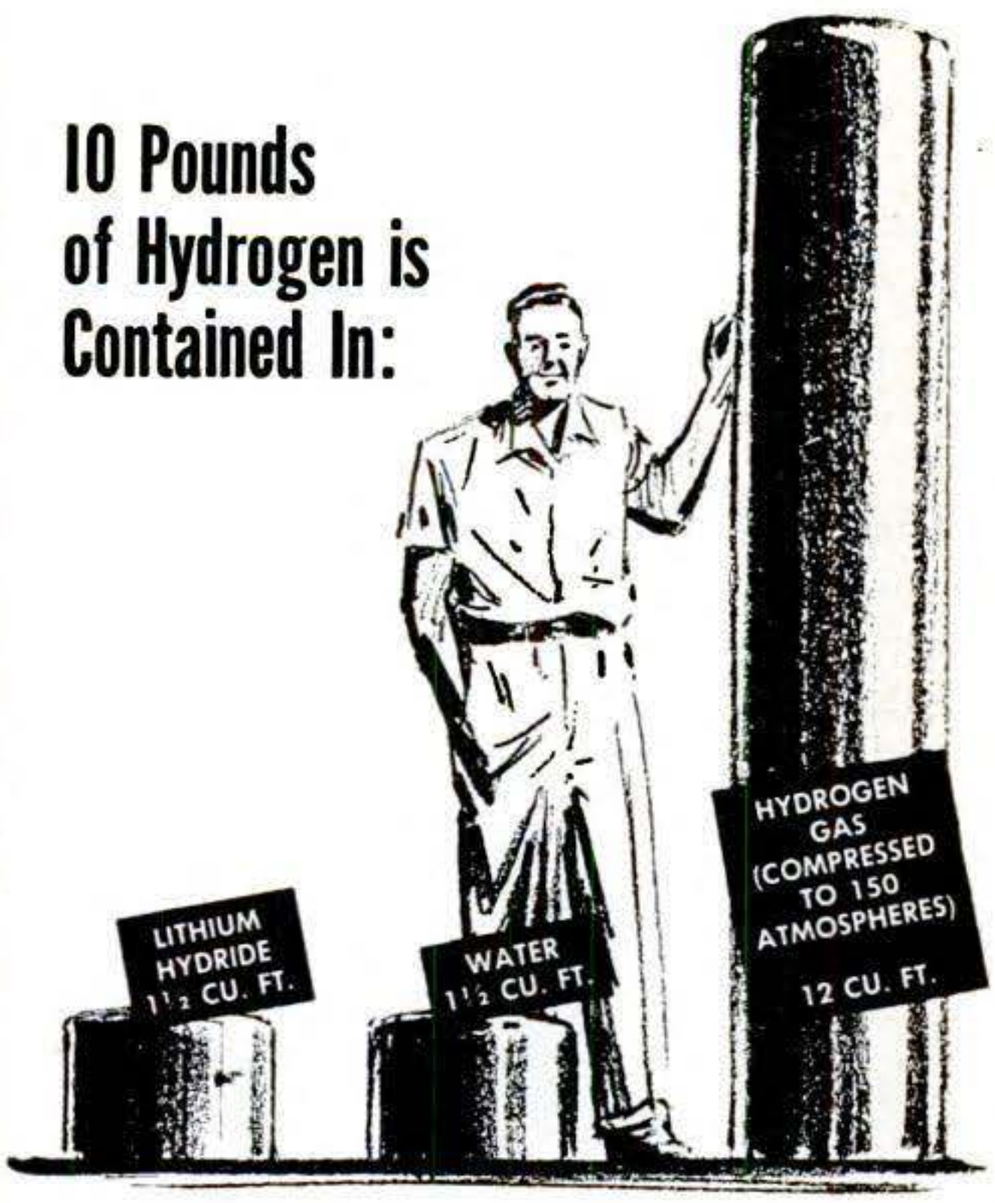
*Dimensions:* Upwards of 26 feet 10 inches long, 4½ feet in diameter, and 21 tons in weight. (These are the dimensions of the Air Force bomb dropped in the Muroc tests.)

*Special mechanical equipment:* A giant parachute to slow the bomb's fall. This would give a piloted bomber time to escape the tremendous range of the blast.

*Firing device:* A proximity fuse, or a barometric switch, to operate the detonator automatically at an altitude above the earth chosen for maximum effect.

*Detonator:* Essentially an A-bomb, to provide multimillion-degree temperature and immense pressure needed to initiate a fusion-type atomic reaction in the surrounding explosive charge.

*Explosive charge:* Hydrogen. (For some reactions, lithium also.) Three varieties of hydrogen, or any chemical compound of any of them, may be used for the explosive charge.

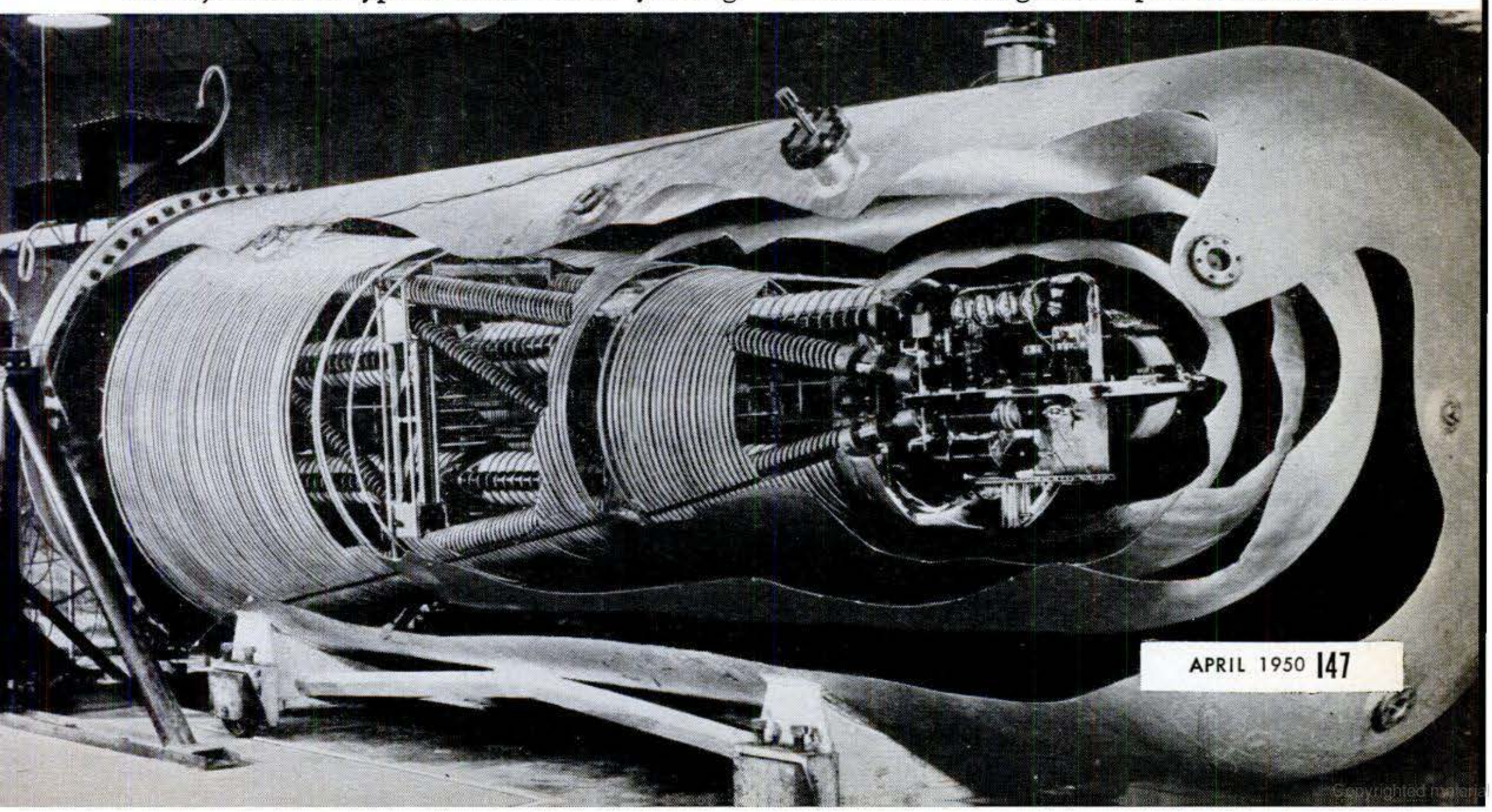



**Lithium hydride or water** could provide H-bomb's hydrogen in more compact form than hydrogen gas, even when latter is compressed to pressure as high as shown.

*Possible varieties of hydrogen:* One or more of the following, all gases, all forming similar chemical compounds:

Protium (ordinary hydrogen). Mass, 1. Common. Obtainable by the action of acid on zinc, and in many other ways.

**Cutaway photo** of Argonne National Laboratory's 5,000,000-volt Van de Graaff generator, below, illustrates type of atom smasher yielding new data on atomic-fusion reactions. Nitrogen gas compressed within seven-foot-diameter outer shell insulates charge built up on innermost shell.





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Deuterium (heavy hydrogen). Mass, 2. Rare. Obtainable from ordinary water in several ways, including fractional distillation and electrolysis. This is the kind of hydrogen in heavy water.

Tritium (extra-heavy hydrogen). Mass, 3. Extremely rare. Radioactive; half life, 12 years. Not found in nature in recoverable amounts. Only recently available. Made in the atomic pile at Argonne National Laboratory, Chicago, from the light-weight metallic element lithium, by artificial transmutation with neutrons. Tritium is a favorite choice in current speculation on the variety of hydrogen used in the H-bomb.

*Possible forms in which hydrogen could be carried in H-bombs:* One of the following:

Hydrogen gas. This could be protium (ordinary hydrogen) gas, deuterium gas, or tritium gas.

Water. (A hydrogen-containing compound, chemical formula $H_2O$.) This could be ordinary water, heavy water, or extra-heavy (tritium) water.

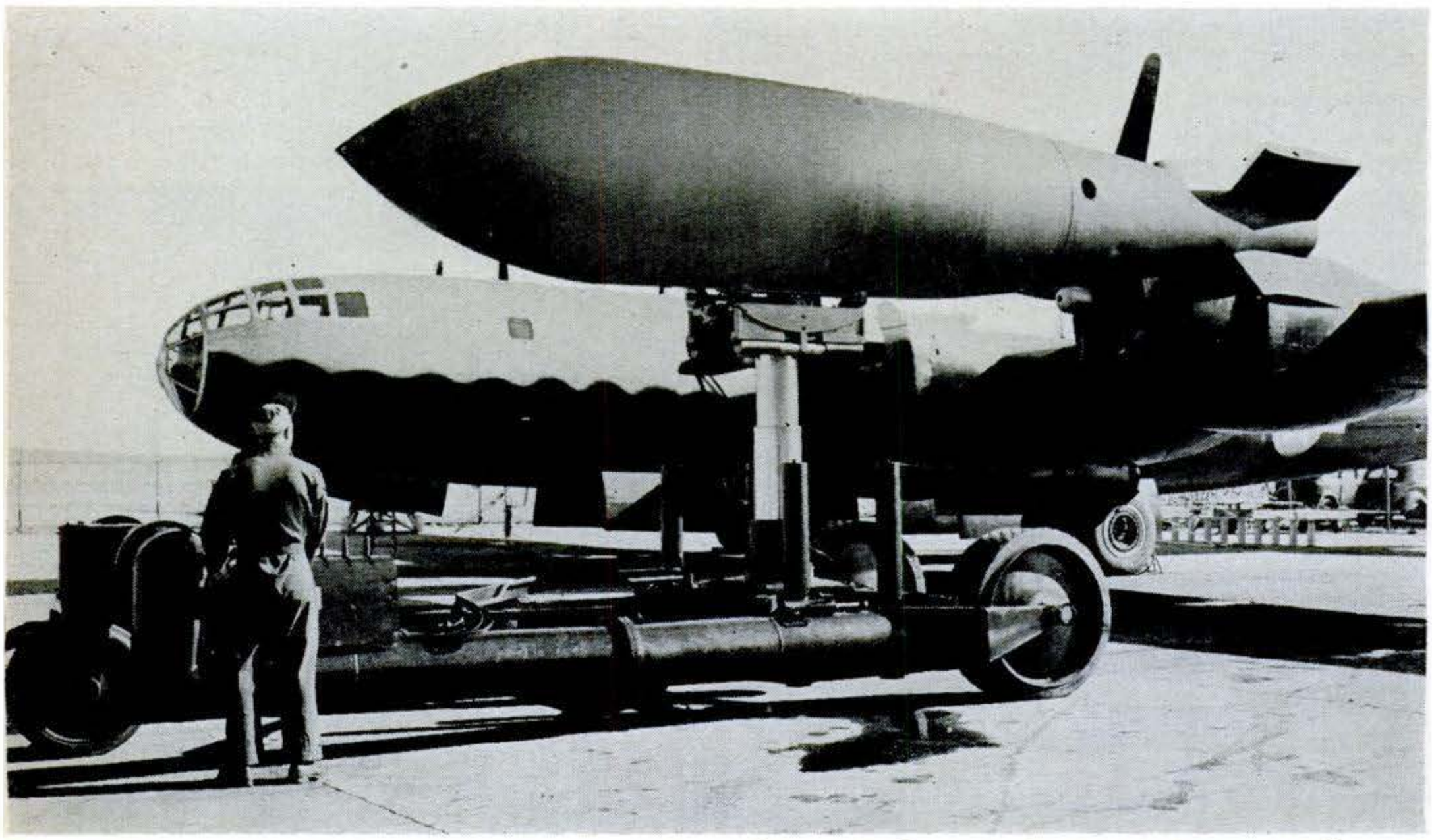
Lithium hydride. (A hydrogen-containing compound, chemical formula LiH.) A blue-gray to white crystalline solid, lighter than water. Specific gravity, 0.82. Has been used as a source of hydrogen for filling balloons. Special preparation of it could be "tailor-made" to contain desired variety of hydrogen. It is especially favored, for several good reasons, in current speculation on H-bomb materials.

*Additional possible ingredient of H-bomb:* Uranium hydride, a black or brownish-gray powder (chemical formula, $UH_3$), or the similar hydride of plutonium (chemical formula, $PuH_3$). Part of the material of the detonator and the explosive charge might be combined, to improve their performance, in one of these hydrogen-containing chemical compounds. Both are known to have been prepared in AEC laboratories.

*Comparative advantages and disadvantages of possible explosive materials:*

Hydrogen gas of any variety offers disadvantages. It would have to be liquefied or highly compressed to squeeze as much as possible in the bomb. Liquefying it would mean keeping a bomb refrigerated until the moment of dropping it, a difficult problem. Probably hydrogen could be compressed in a bomb to a pressure as high as 150 atmospheres or more than a ton to the square inch, which has actually been used in commercial gas-storage cylinders. Even so, its bulk would be excessive, as might also be the weight of the massive container strong enough to hold it.

Water and lithium hydride offer much more compact sources of hydrogen. Ten pounds of hydrogen is contained in 1½ cu. ft. of either, while 10 pounds of hydrogen gas compressed to 150 atmospheres takes up



**Size of H-bomb a plane could carry** is vividly shown by U. S. Air Force's monster 21-ton bomb above, the biggest for which figures are known. It contains conventional explosive.



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**Medical Problem:** At least 40,000 persons may be severely burned by an A-bomb, many more by H-bomb. Here is official estimate of supplies needed for ideal medical care of *just one* such casualty. Effort to assemble material for a photo revealed no New York hospital had it all.

12 cu. ft. These figures, for ordinary hydrogen, vary for deuterium or tritium, but in all cases favor the compounds.

Lithium hydride has an advantage over water in slightly lighter weight for the same hydrogen content. Other considerations also favor it. It could be a source not only of hydrogen, but also of lithium, for powerful lithium-hydrogen reactions.

### *Can the H-Bomb Destroy the World?*

The world will not end in one blinding flash when an H-bomb goes off, scientists hold. But other far-reaching consequences are not impossible. If designers succeed in their "probably attainable goal" of building an H-bomb, Prof. Albert Einstein declares, "radioactive poisoning of the atmosphere and hence annihilation of any life on earth has been brought within the range of technical possibilities."

Like A-bombs but on a far greater scale, neutron-emitting hydrogen bombs would turn a part of air, water, or soil into long-lived radioactive substances. If enough H-bombs could dangerously contaminate the whole atmosphere with them, presumably Geiger counters would click a warning long before, and the alternatives would be to set off no more H-bombs—or face extinction. END



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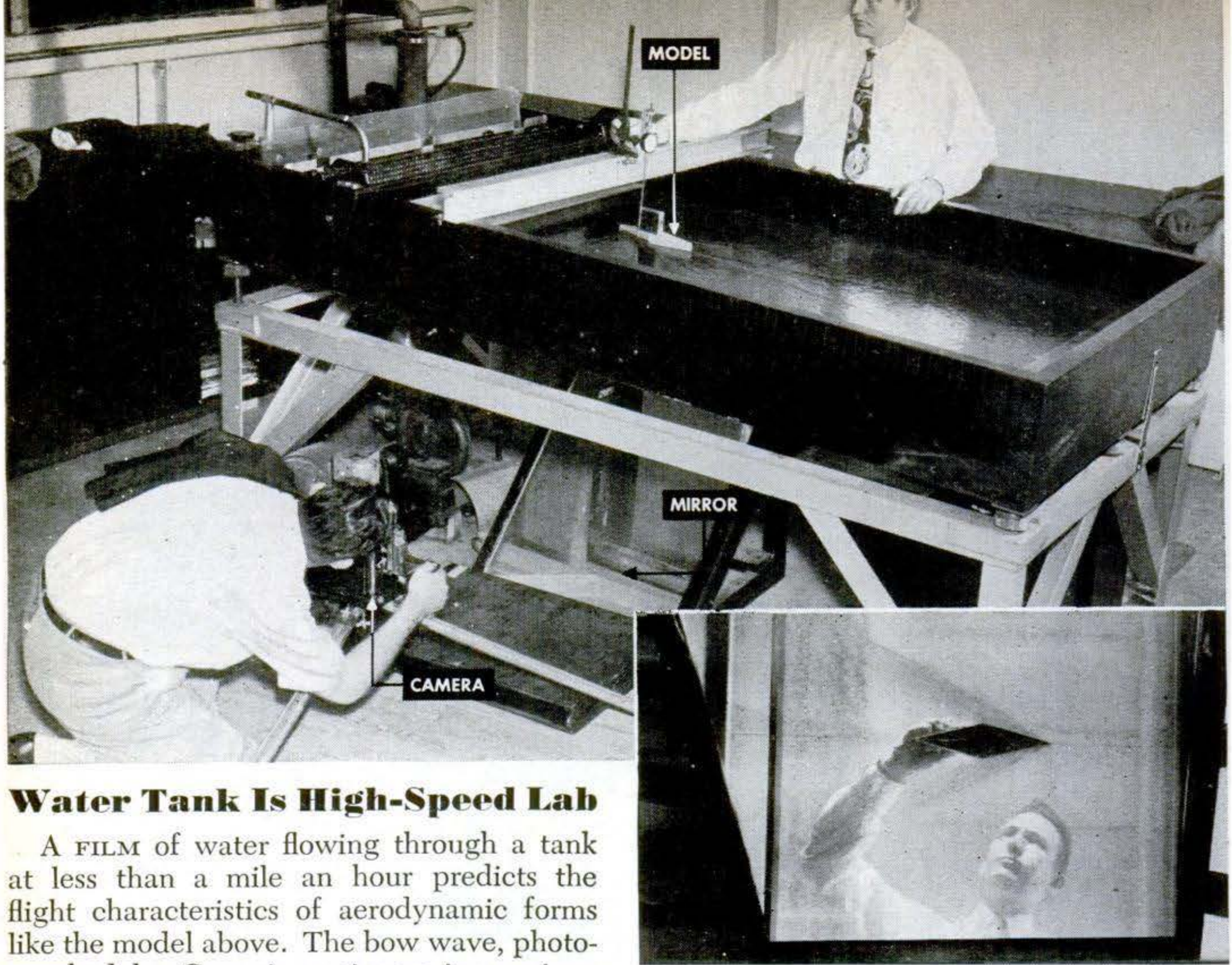
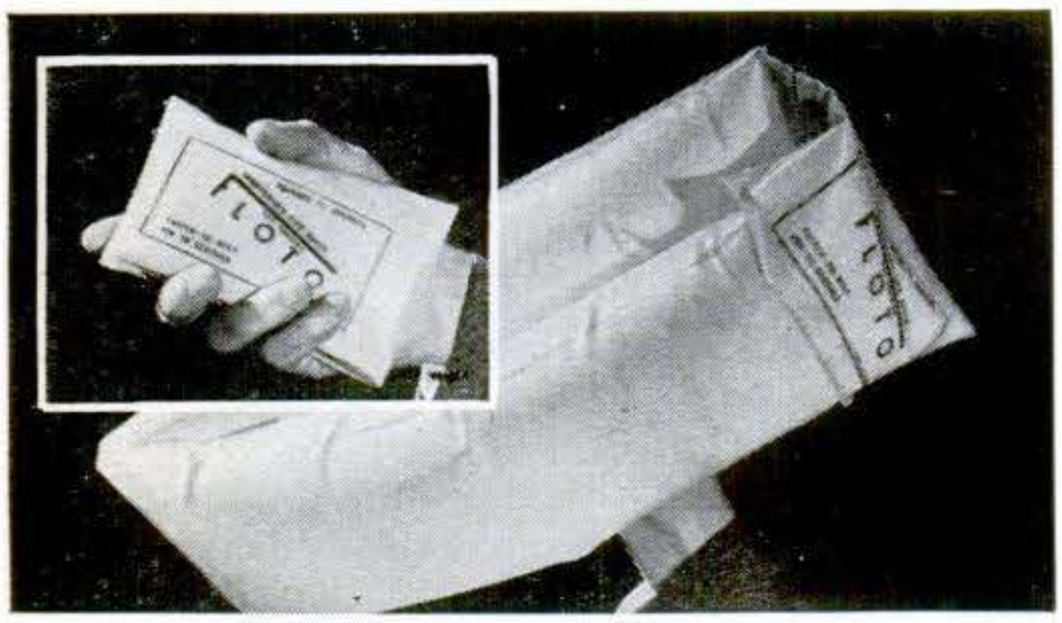


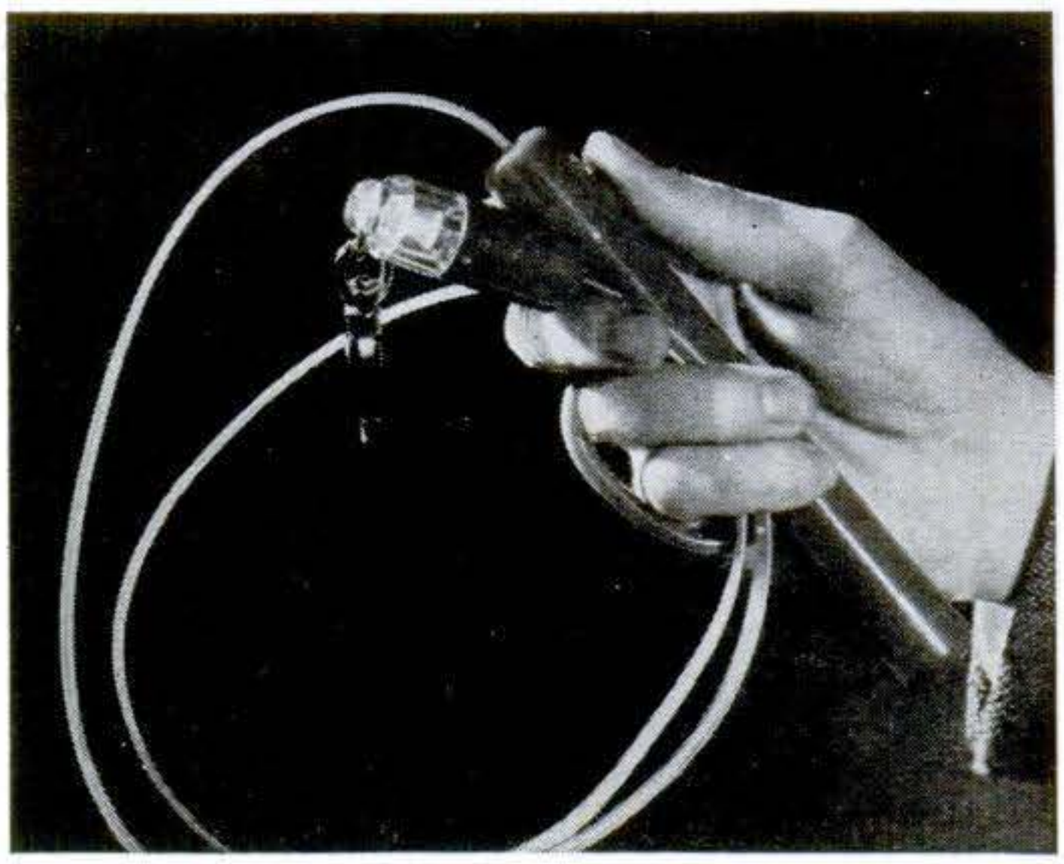

## Water Tank Is High-Speed Lab

A FILM of water flowing through a tank at less than a mile an hour predicts the flight characteristics of aerodynamic forms like the model above. The bow wave, photographed by Convair engineers in a mirror under the transparent bottom of the tank (right), corresponds to the shock waves a similar shape would make in supersonic flight. In a similar table-top flight lab used by North American Aviation (PS, Oct. '47, p. 92) the model moves instead of the water.




## Life Preserver Inflates Itself

SPORTSMEN or vacationists attracted to water for fun and frolic now can carry along a pouch-size, self-inflating life preserver that fits into a pocket or clips onto a belt or clothing. After an accidental dive into the drink, you just squeeze the compact package shown in inset above. Almost instantly, a carbon dioxide cartridge is triggered to release gas, inflating a life preserver (large photo) that will keep two men afloat. After the $2.95 Floto® has been used, it can be sent back to the manufacturer, the National Reinforced Plastics Corp., Nashville, for recharging.



## Dog Leash Lights Up

CROSSING streets at night with your dog is less hazardous with this novel leash, which has a small electric light at the end that snaps onto the collar. Wires run through the plastic strap to a hollow handle containing pencil-type batteries operated by a switch. The manufacturer, the Leash-Lite Co., of Long Beach, Calif., also claims the gadget is handy to locate a pooch when he is let loose to run in a field after dark.



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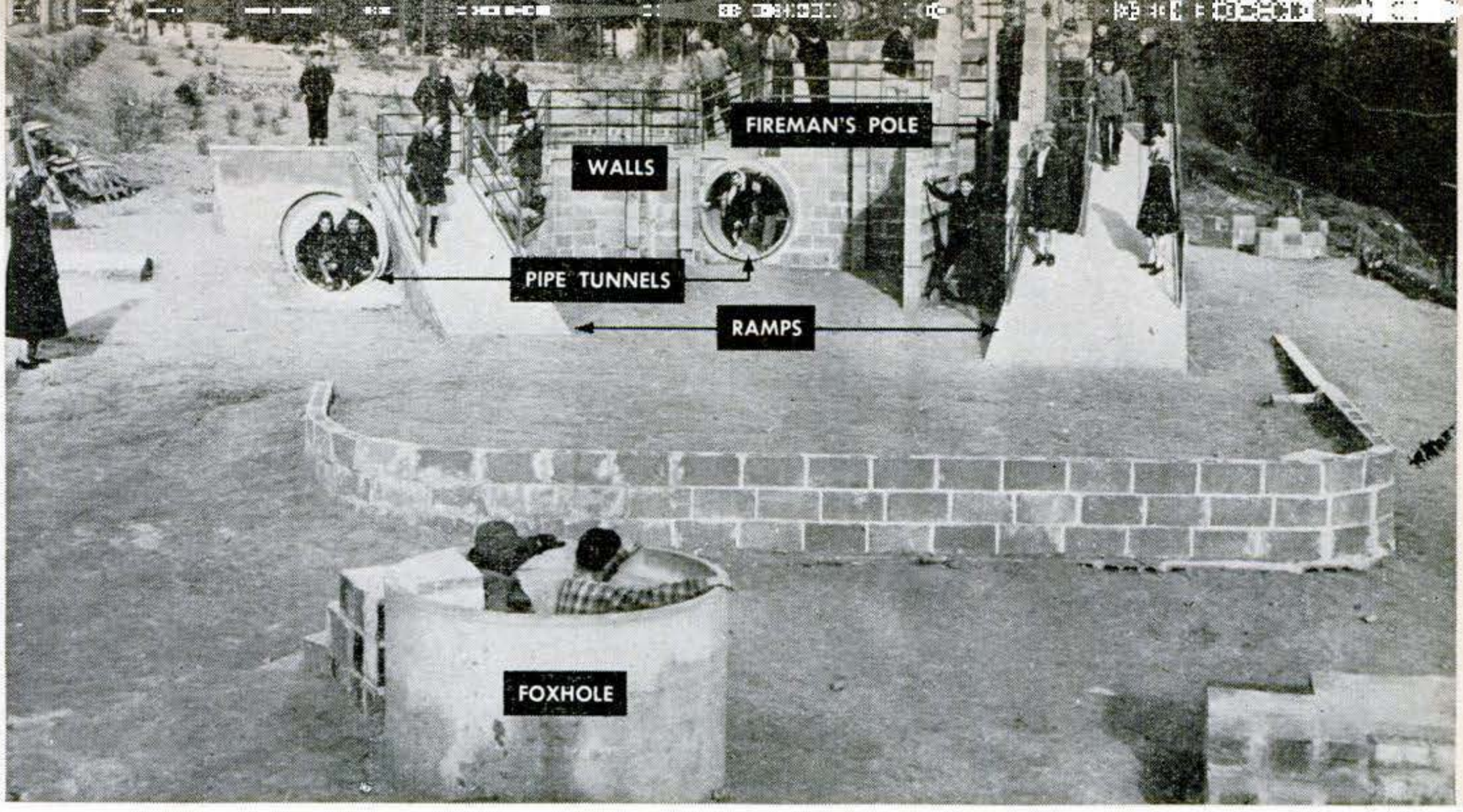


**Playground is based on what kids really like to do instead of what adults think they like.**

# Dads Build Playground

EVER bring home an expensive toy for your youngster and have him toss it aside in favor of an old tin can? This happened once too often to a father in Silver Spring, Md. The result is a revolutionary new playground based on a child's desire to improvise his own games.

The playground, built mostly of cinder blocks by Parkside School dads, furnishes the raw materials and the kids make up their games as they go along. Its attractions include "secret passages," nooks and crannies for hide and seek, a fireman's pole, an airplane, a boat, and a foxhole.

There are concrete ramps to climb, pipe tunnels to crawl through, a structure with three different levels from which children can jump into a sand pile, an open-top playhouse for the girls, and an outdoor amphitheater that can be used as a classroom in good weather.

A big advantage, the parents feel, is that the play facilities can't be monopolized by the bigger kids, like the swings and slides of conventional play spots.

Best of all is the cost. By working evenings, the dads figure they got a $10,000 playground for about $2,600. END

**Cinder blocks** plus imagination equal a pirate ship under full sail. Many of fathers who designed and built playground are scientists at nearby Naval Ordnance Laboratory, White Oak.

**An airplane** that never gets off the ground whisks load of children off to other side of make-believe world. Fire department furnished flood lights so dads could work at night.



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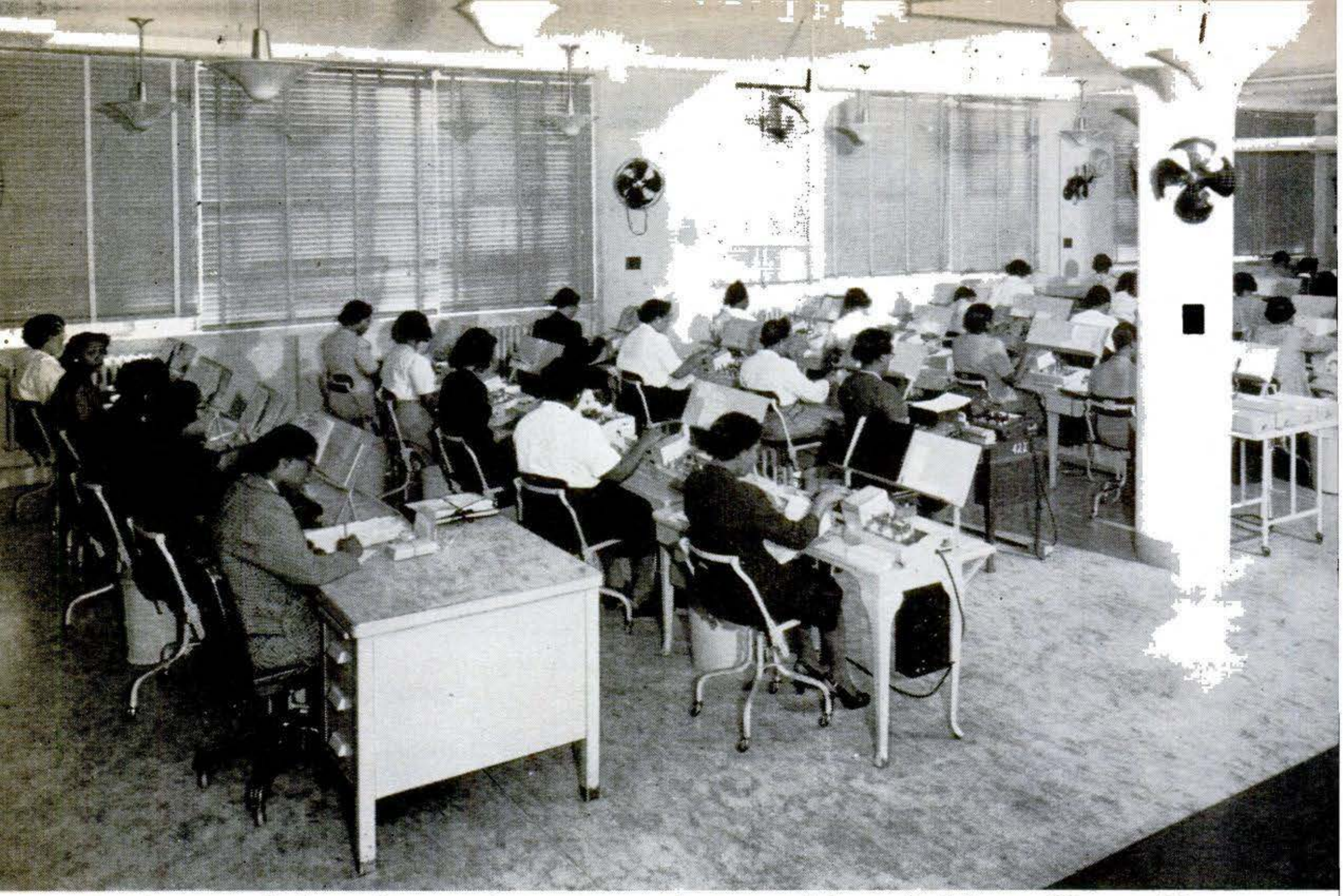

**This battery** of electric-key punch operators shows a small part of the 3,000 machines that chew up and digest the billions of facts and figures that will go into Uncle Sam's 1950 census.

# How Machines Turn You Into Statistics

**Biggest U. S. nose count is expected to turn up 151 million Americans, and machines will make the tally.**

***By John F. Loosbrock***

When 151 million noses have been counted and all the questionnaires filled out by the more than 140,000 enumerators who started ringing 45 million doorbells on April 1, the job of taking a national census will just have begun. Then the machines take over, chopping you up into statistics.

This year more machines, including some new wizards with the digits, will do a faster job than ever. The modern business machine, in fact, got its start in life during the census of 1890, when the first punched-card machine was used, cutting the tabulating time in half. It was the invention of Herman Hollerith, a census expert. Previously, the Census Bureau had been running a close race with itself, barely completing one count before data for the next census poured in.

And speed—speed that only electronic calculators can achieve—is important. For one thing, a state's population determines its share of the 435 seats in the House of Representatives for the next 10 years. And the Census Bureau must put these determining figures into the hands of the President not later than December 1, 1950.

But the mere population count is only a fraction of the total task. The figures have to be broken down into dozens of combinations of classifications—by sex, age, race, vocation, and many more. And according to law, the entire job has to be finished and the results published by December 31, 1952.

The vast amount of information acquired by the door-to-door census takers will be



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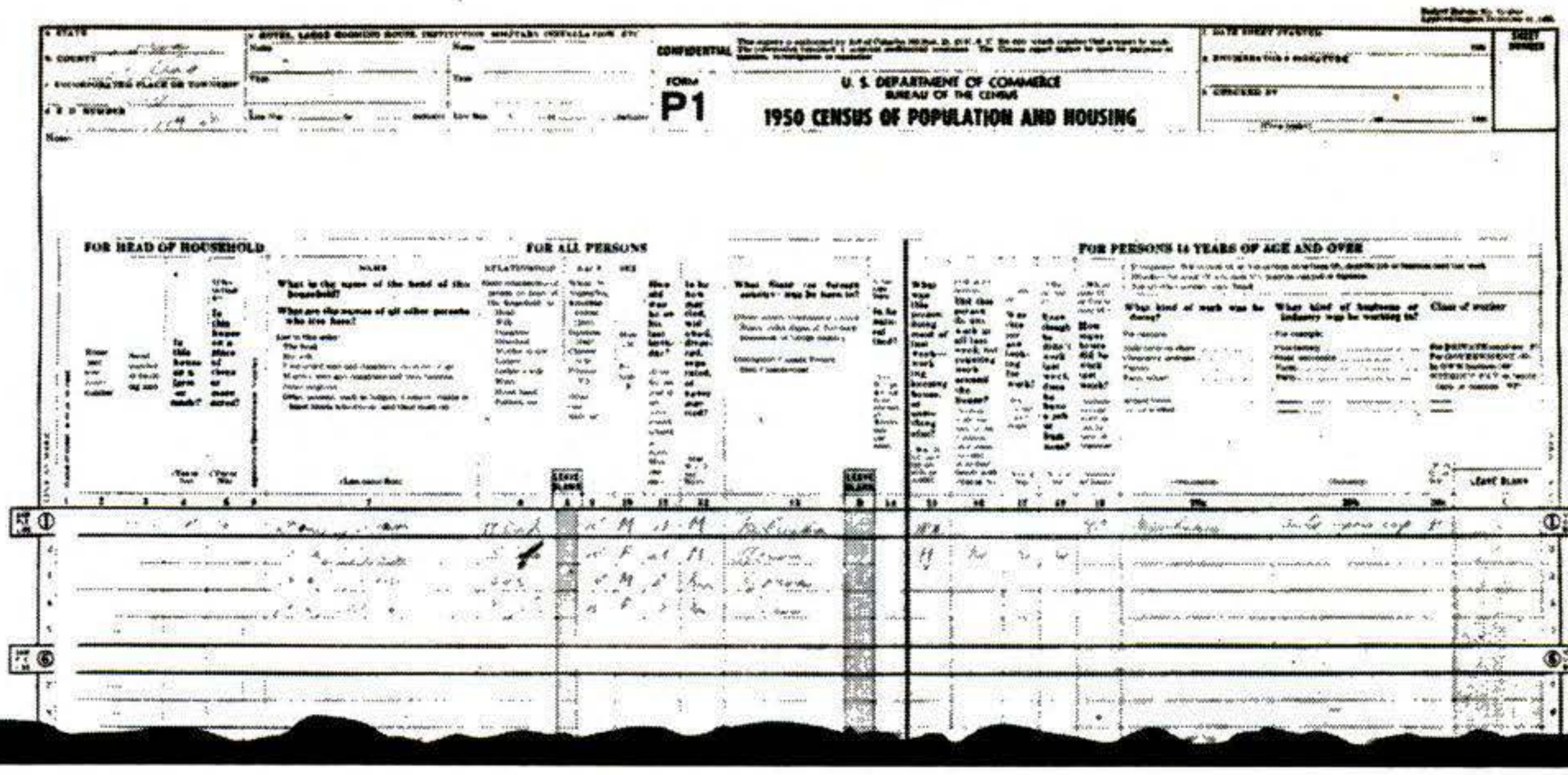



**Here's the top part** of the questionnaire the enumerator fills in. This is the family of mythical John Doe—he's 31, married, white, born in Nebraska, works 40 hours a week in a garage.

digested by 3,000 ingenious gadgets that sort, add, subtract, multiply, divide, and what have you. You and your 151 million neighbors will become a series of little rectangular holes punched in stiff cards.

Each hole represents a characteristic—there's one each for your age, your job, your sex, your marital status, your birthplace, and a lot more. They're punched out by 2,200 electric-key punch operators, each of whom can turn out about 1,000 cards a day.

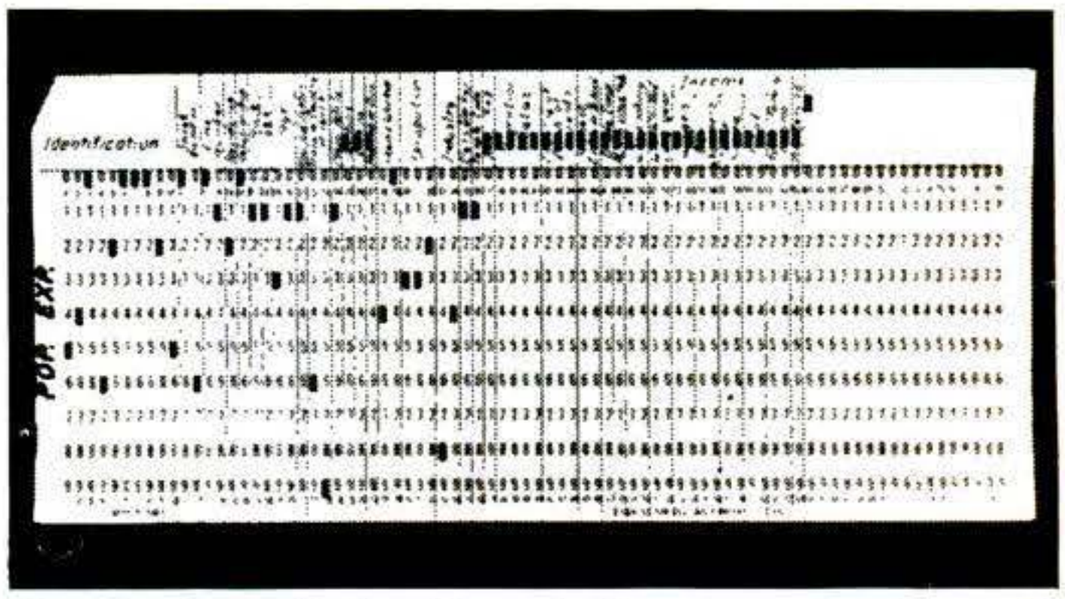
The punch card is the foundation of the Bureau's entire machine-tabulation system. In theory it's simple. The heavy card acts as an insulator for electrical current as it passes through the various machines. The holes allow current to pass through only in a given pattern. Thus the pattern of holes in your card allows the machine to extract information pertinent only to you.

Once the cards are punched and checked for accuracy, they are run through a sorter. This has 13 pockets, 12 of which correspond to the 12 possible hole positions in one column on your card. The 13th pocket receives those cards that, for one reason or another, have no holes punched in that column. The sorter shuffles 450 cards a minute into one of many series of combinations, depending on the particular dope needed.

The sorted cards are then fed into what census people call the work-horse of the machine-tabulation system—the unit counter. It's a high-speed—400 cards a minute—gadget that comes up with as many as 60 different answers out of one group of cards.

For example, you might want to know the total numbers of farmers, coal miners, bankers, and so on, in any number of combinations of color, age, employment status, or

**Operators punch out holes** on card to correspond with data on enumerator's questionnaire. Drumlike device is new copy-holder that moves up electrically as operator pushes button.




**Here's how John Doe** looks as a punch card. Each of 12 columns represents a general heading, such as race, age, religion. Doe's answers to the census-taker determine the hole pattern.



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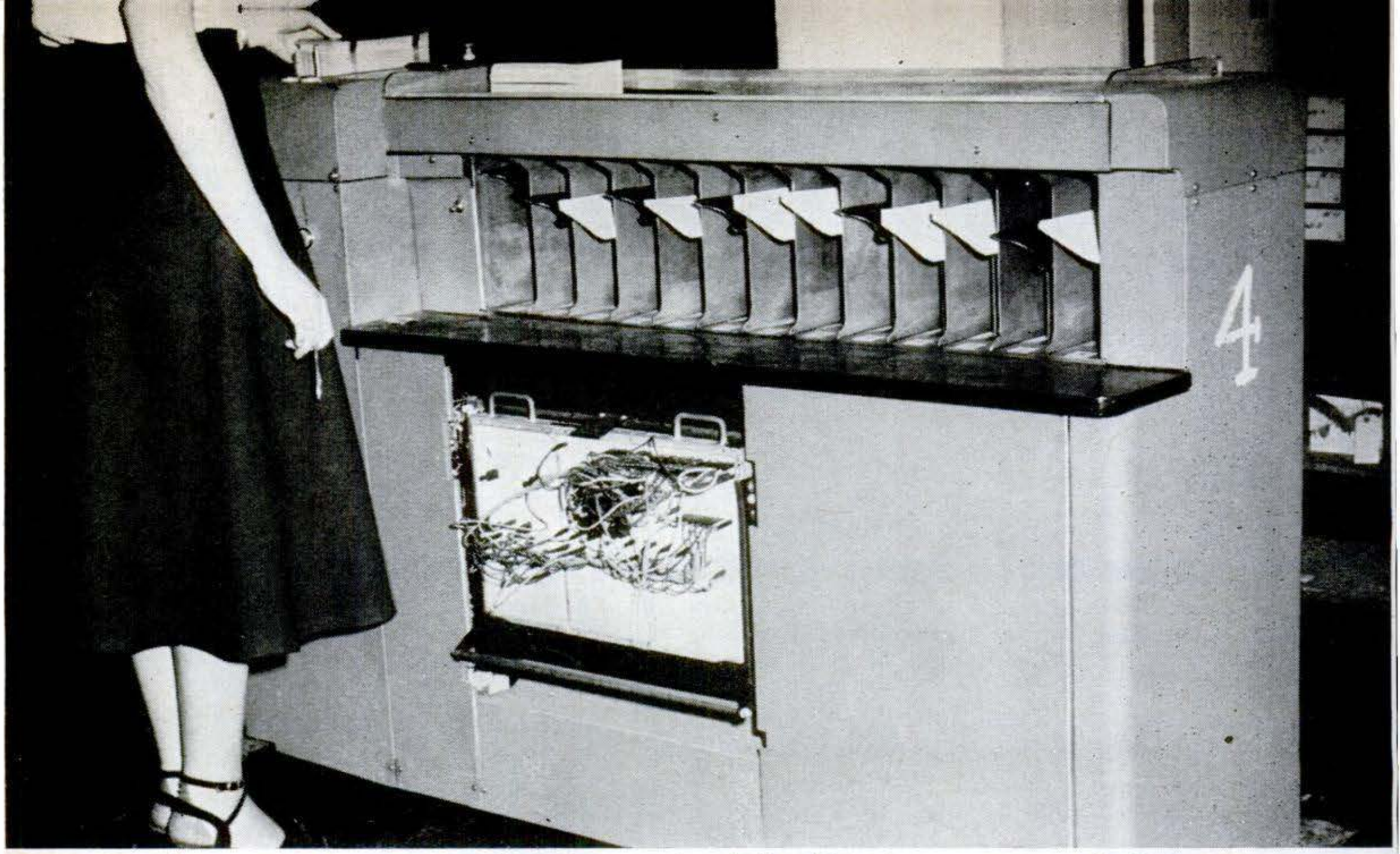

**The multi-column sorter** is a new machine developed by the Census Bureau and used for the first time this year. It sorts punch cards, like a postal clerk sorts letters, into 13 pockets, one for each of the 12 columns on a card plus one pocket for unpunched cards. Unlike older-type sorters, it can separate a pile of cards into groups based on dope in more than one column.

what you will—how many farmers, say, are 32 years old, married, living in Idaho, and war veterans. Most ingeniously of all, it detects inconsistencies and throws out cards that contain obvious errors. For example, your card might list you correctly as a veteran, yet give your age as nine. The machine, without skipping a beat, says, "Whoops! This can't be" and kicks out your card to be returned for a checkup.

International Business Machines has developed a new "Electronic Statistical Machine" that will get its first workout during the 1950 census. It's an electronic job that combines the tasks of sorting and tabulating, handling 450 cards a minute. Thirty-two of them will be used this year. To give you an idea of what the nose-counting job might be without this and other machines, it would take 500 persons all their working lives to accomplish by hand what the 32 ESMs will do in about two and a half years.

These gadgets are the backbone of the Census Bureau's tabulation process, but there are also auxiliary machines that perform special intricate jobs. One is the summary punch, which is coupled to a tabulator to punch separate cards for totals of figures. Another is the reproducer, which reads data from one card and reproduces it on another. And there's a fancy electronic calculator that adds, subtracts, multiplies, or divides at a maximum speed of 6,000 computations an hour.

By the time 1960 rolls around, the census people hope to have a battery of electronic geniuses that will outshine even this year's streamlined models. One of these, already developed but still having bugs, is called a "document-sensing" machine. To use it, the enumerators will fill out a special-size questionnaire, using an electrically conductive, metallic ink or pencil. The questionnaires will be shipped to Washington and fed directly into the machine. It will sense the marks electronically and automatically punch out the cards.

Another electronic marvel, now being built under the supervision of the Bureau of Standards, is unimaginatively called the "Census Electronic Machine." Instead of punch cards, it uses data magnetically recorded on a steel tape. It's been nicknamed "the machine with a memory". If the tape data contains an error, the machine stops the part of the computation in which the error is involved, but goes on and finishes the rest of its calculations. When the tape error has been corrected the machine picks up the abandoned computation and finishes it. It's so fast that scientists can't feed in data fast enough to tax its capacity. END



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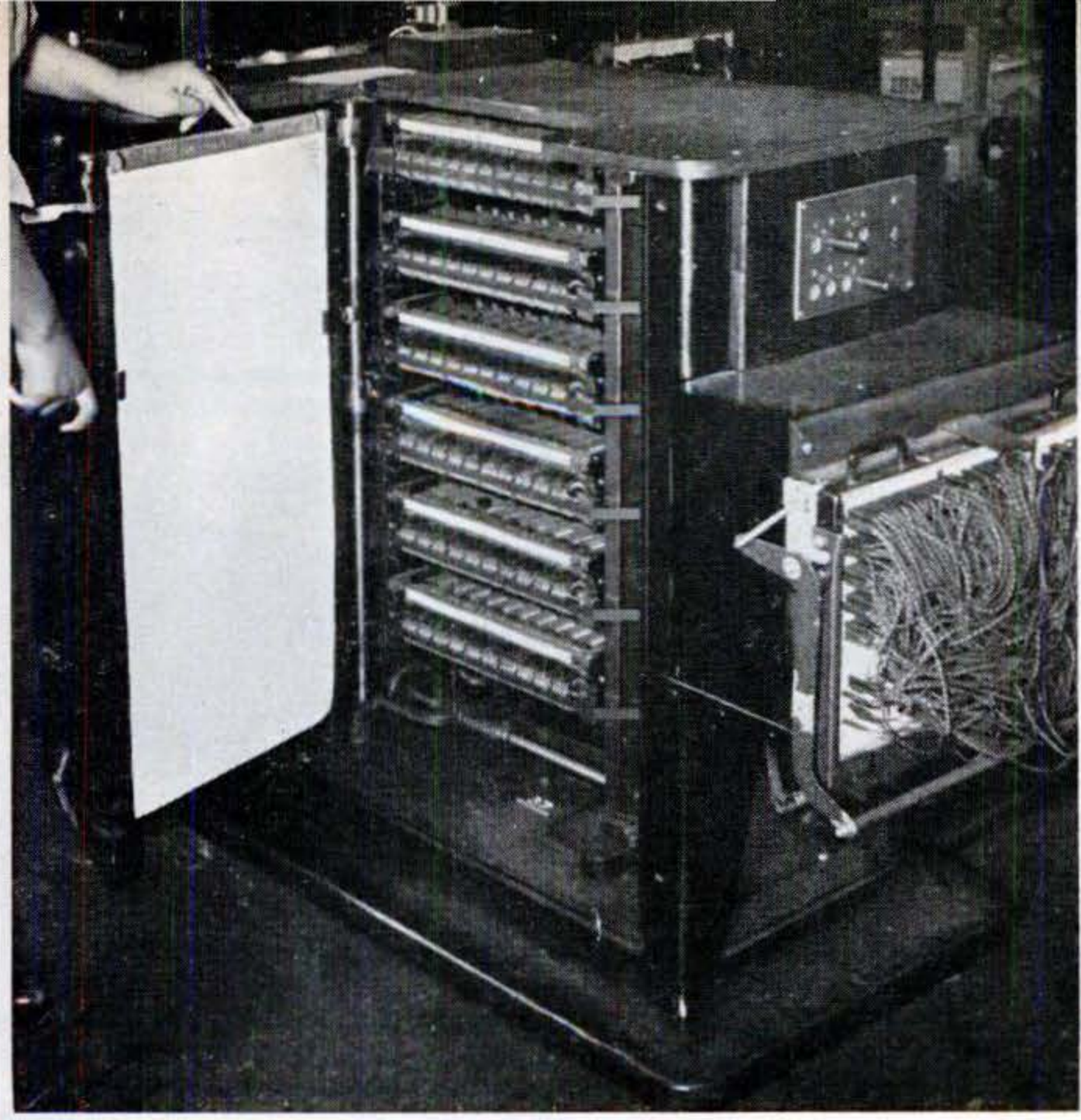
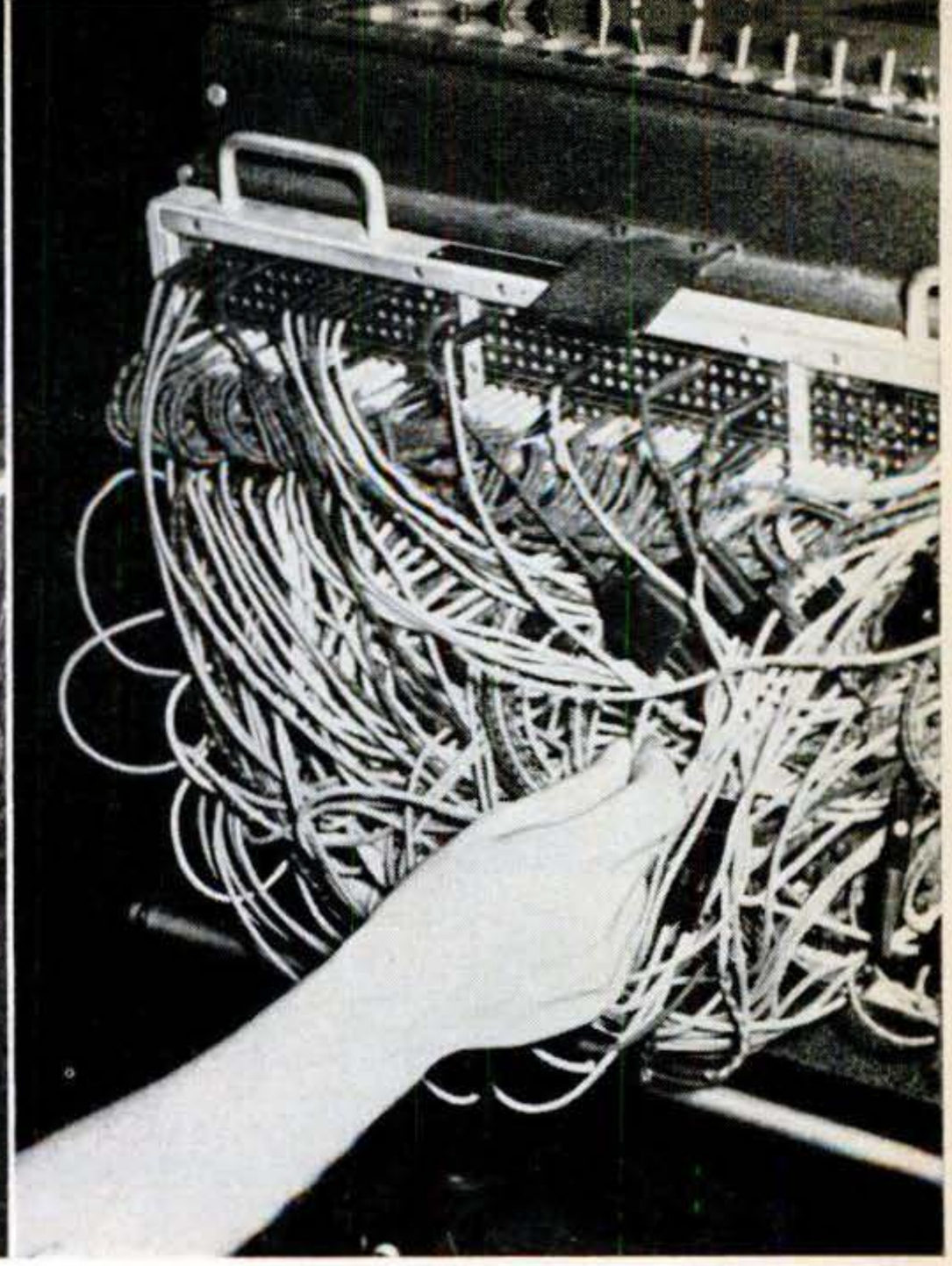
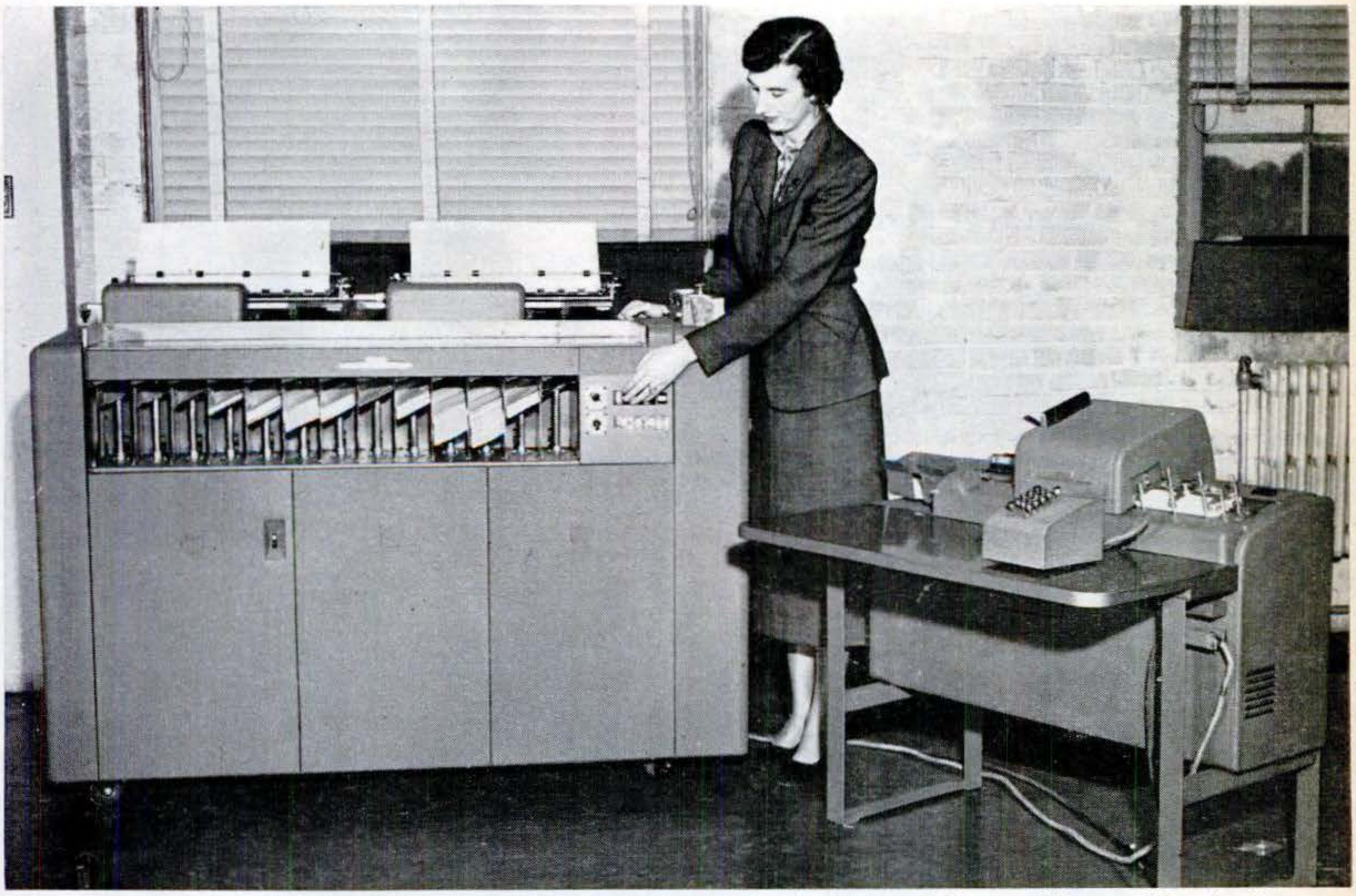


**This high-speed tabulator** is known to census people as the "workhorse." It handles 400 cards a minute and can come up with as many as 60 different totals out of a single group of cards.



**The electric plugboard** is the brains of the tabulation equipment. It has plugs and jacks like a telephone switchboard that can be connected in various combinations for different information.



**This super-dooper census gadget** was built by International Business Machines. It combines electronically the functions of the multi-column sorter (opposite page) and the tabulator (above). Thirty-two of them will be used for the first time during the 1950 census. But by the time the next population count rolls around, in 1960, chances are even this model will be outdated.



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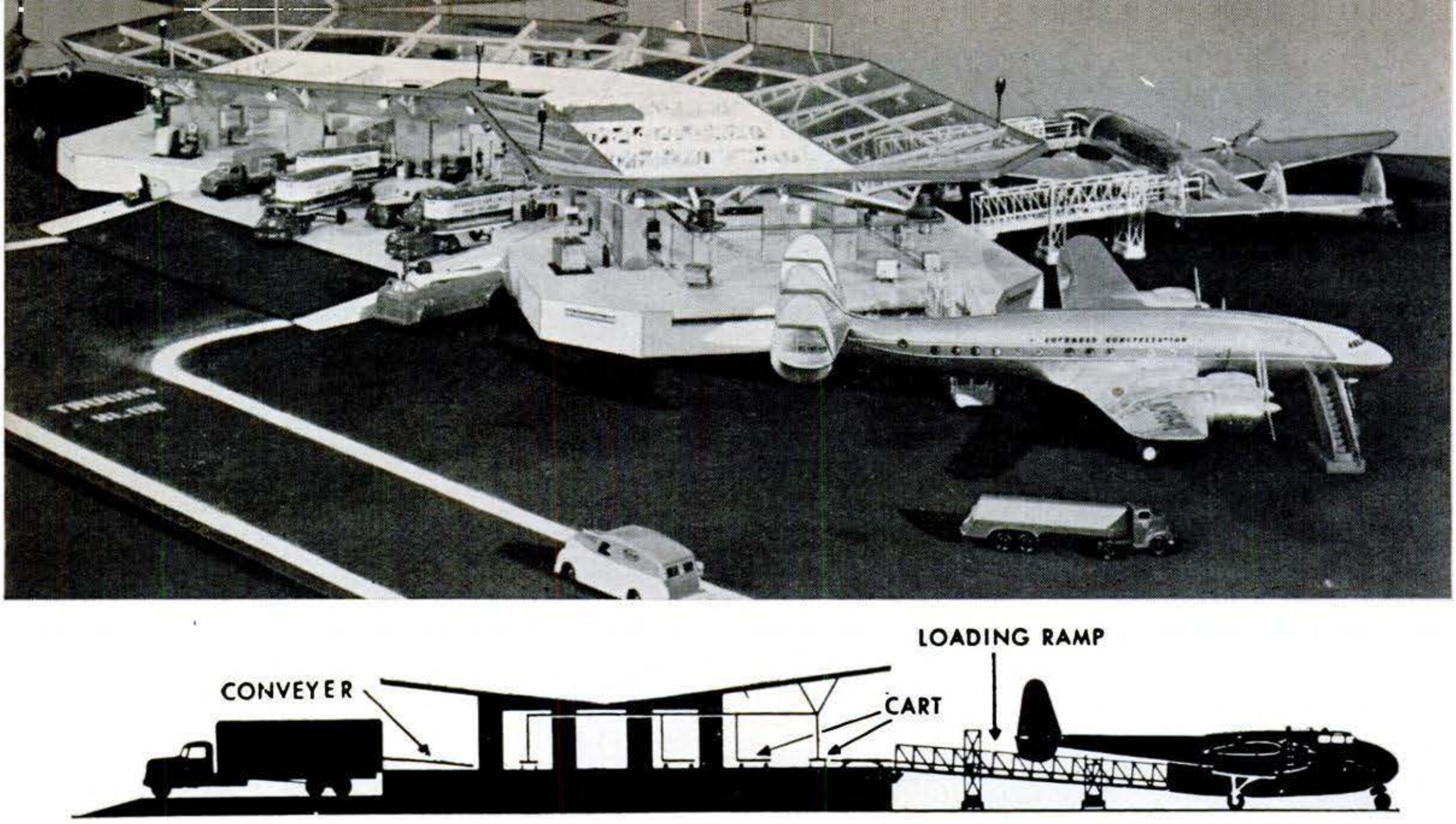


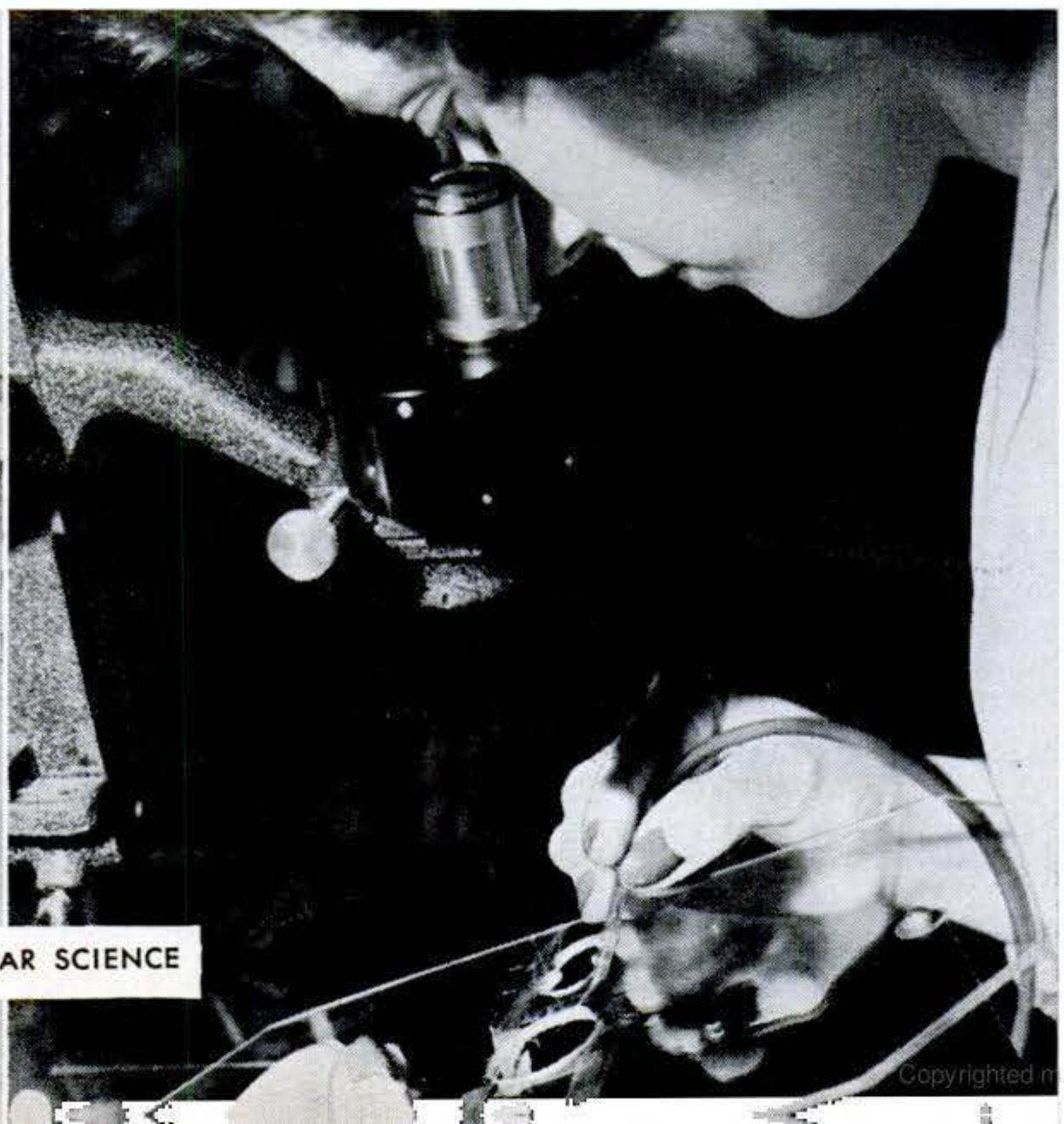

## Plane Dock to Speed Air Freight

AIR freight goes fast enough in the air, but bogs down on the ground when it must be moved between the plane and a truck. Lockheed experts think they've eliminated this bottleneck with a plan for a new kind of terminal. It would use almost completely automatic equipment to transfer the freight.

Basis of the plan is a V-shaped building, shown in drawing and model above. Airplanes could stop anywhere around the building except inside the V, where the truck dock is located. Portable conveyers, adjustable in height and length, would connect the building and planes. Small carts, hooked to a continuously moving, endless chain, would transfer goods in the building.

## Scales Made of Quartz Thread

ONE hair on your head is fifty times as thick as the fibers of quartz below. Some are so fine that 10 miles can be wound on a small spool made for 250 yards of cotton thread. The fibers, used in ultrasensitive chemical scales, are made by drawing threads from a heated quartz rod. The speed at which the winding wheel (left) pulls the thread determines its thickness. With these strong, spidery filaments, balances can be made (right) that will weigh to 1/30,000,000th of an ounce.





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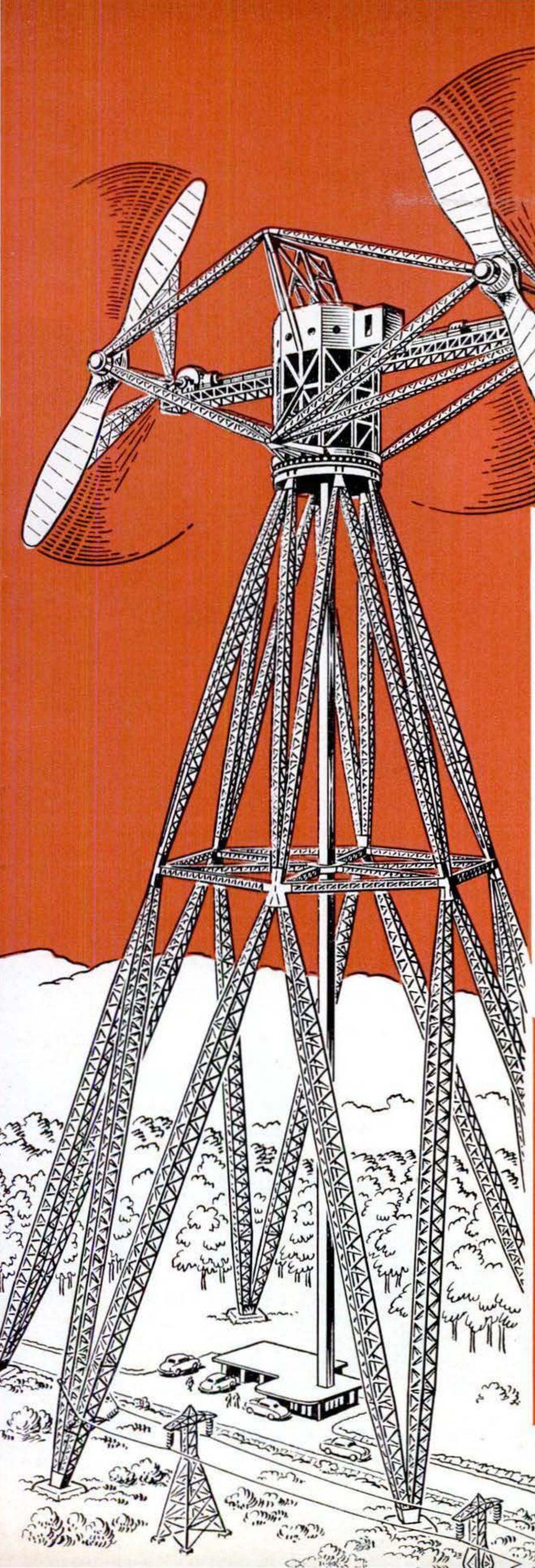
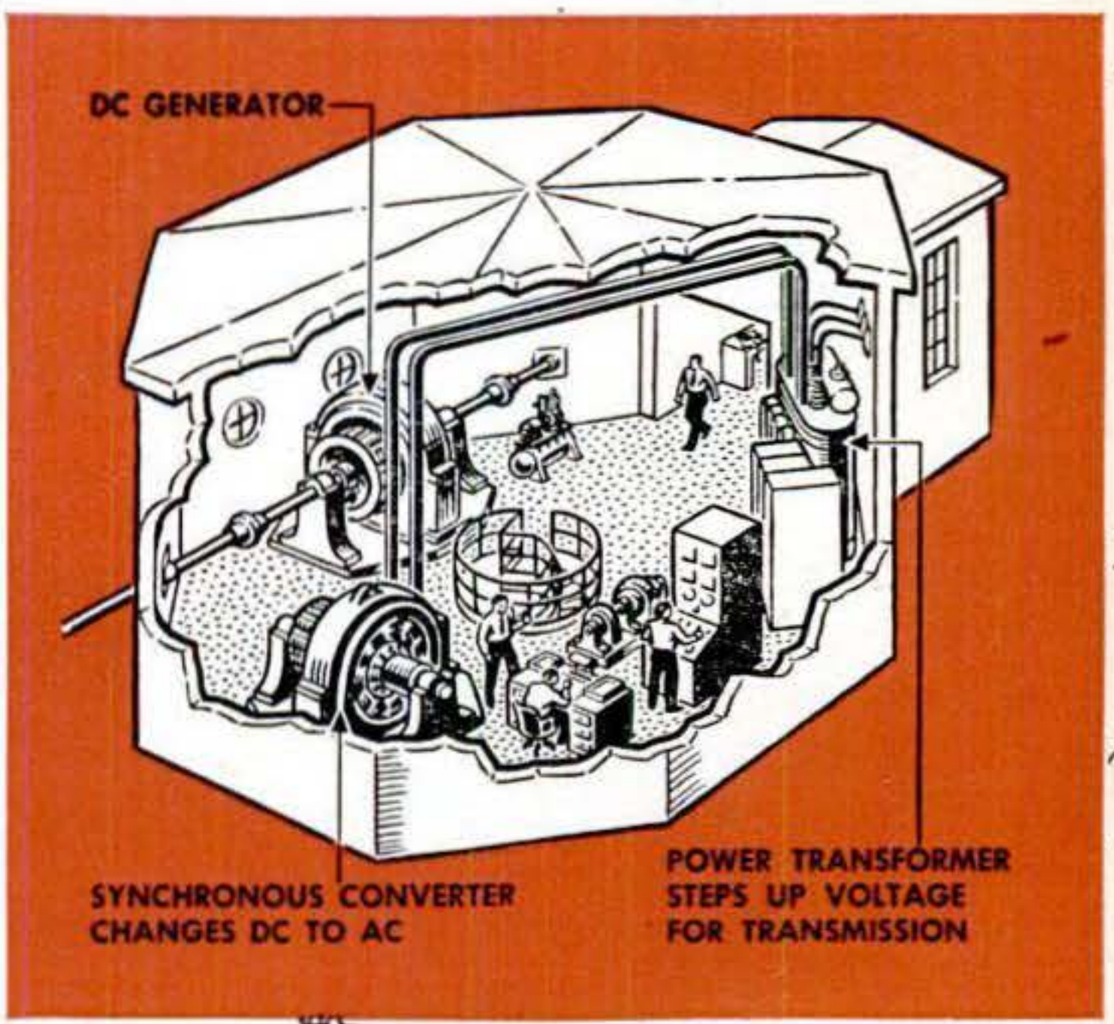
# Power Plant on Stilts



THIS drawing shows what may someday be the answer to engineers' dreams of large-scale electric power from the wind. The design, made by Percy H. Thomas for the Federal Power Commission, envisions a 475-ft. tower topped by two giant rotors, each 200 ft. in diameter. These are mounted on a large turntable that also houses the generating equipment (small sketch).

Plans are based on experiments near Rutland, Vt. (PS, July '41, p. 115). Batteries of these two-bladed, wind-powered generators, each with a 7,500-kw. capacity, could be used, says Mr. Thomas, to supplement conventional hydroelectric or coal systems. The U. S. Bureau of Reclamation likes the idea for dry Western areas short on water power.



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# Bits and Pieces Build Grasshopper

**Wings folded against fuselage, tiny plane is ready to be towed home for service and repair.**

**Junk-yard scavenging and spare-time work give Navy man a parasol-wing one-seater for only a $200 outlay.**

***By Andrew R. Boone***

A NAVY chief aviation machinist's mate in San Diego has built himself an airplane—for less than $200. He did it by scavenging most of his materials from old crack-ups and junk yards.

W. E. White, the Navy man, wanted a personal plane badly. He held ratings as a commercial pilot and top-grade assembly and repair mechanic. But buying his own flying machine would be expensive. So last year he began collecting. He took tubing from crashed planes. He ripped instruments out of junked aircraft. Parts of three little engines that had powered personal planes made one good engine.

In his one-car garage-workshop White set to work on a stubby wing, fuselage, engine mount, and landing gear. Only when his own power tools couldn't handle a part did he turn to commercial shops for help. He completed his plane by working during his spare hours over a period of eight months.

What does it cost to scavenge an airplane? That depends on what kind of materials you use and your own resourcefulness. White used steel tubing for the fuselage from the pilot's headrest forward, and spruce from the headrest to the tail. The wing is fabric-covered wood.

Here was White's bill for materials: tubing $6, welding gas $7, spars $10, small wood parts $10, balsa to fair the struts $1, sheet metal $6, fabric and dope $50, engine $50. Miscellaneous other items brought the total to a shade less than $200.

When White pours four gallons of fuel into the tank and crowds his slight 120 pounds into the tiny cockpit, the take-off weight of his home-made plane is 450 pounds. He flies around the San Diego Bay area but because his ship is experimental he stays within gliding distance of the airport.



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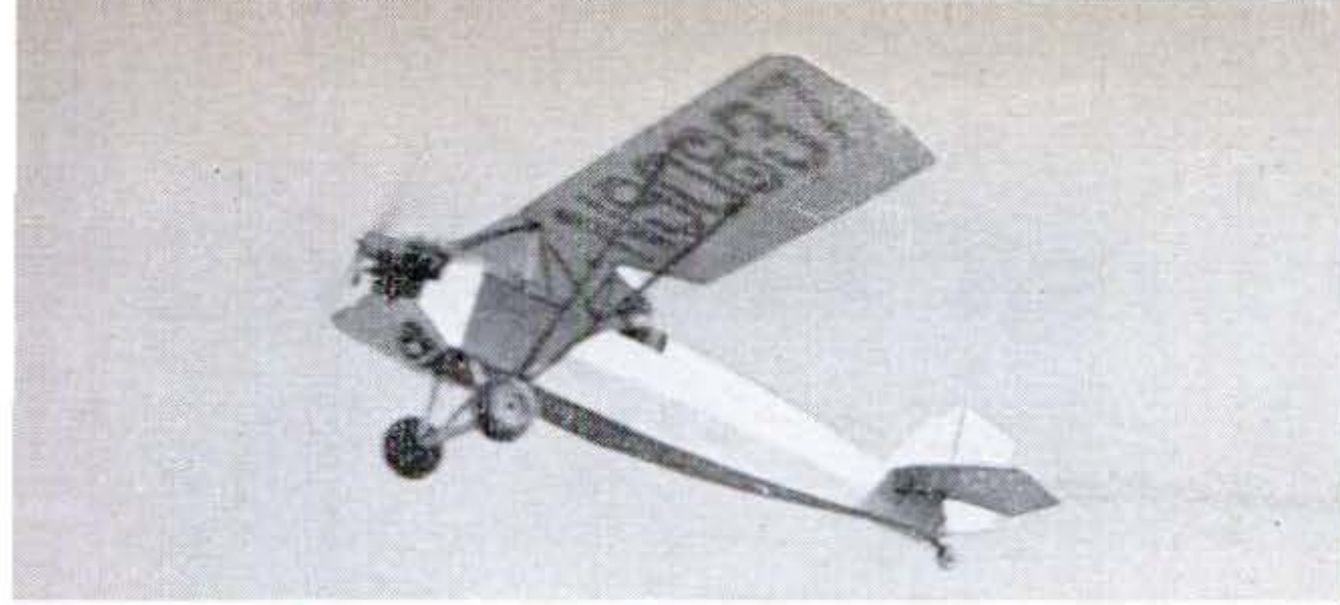
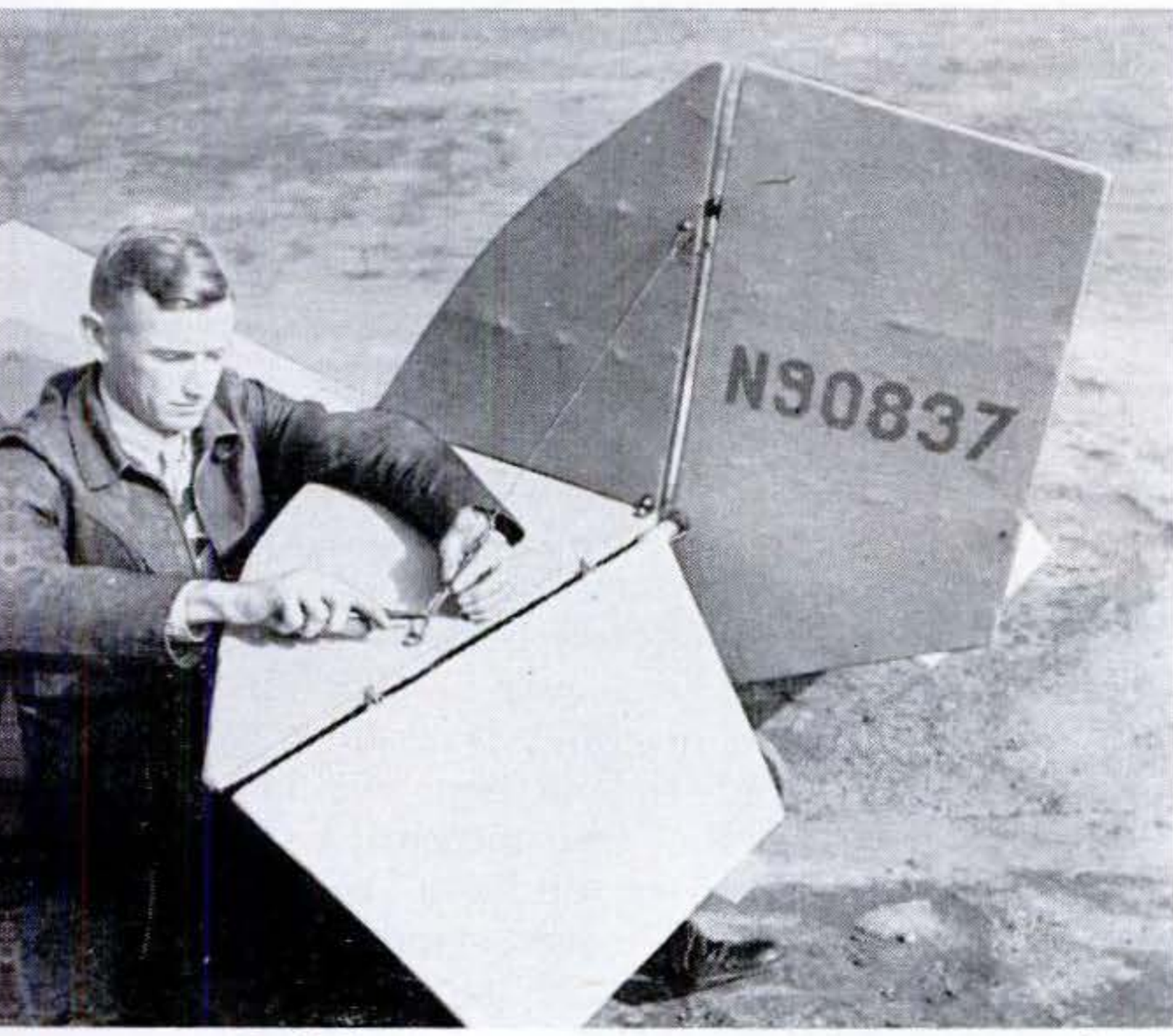


**W. E. White's plane cruises** at 60 m.p.h. Wing spans 20 ft. Plane is 14 ft. 9 in. long.

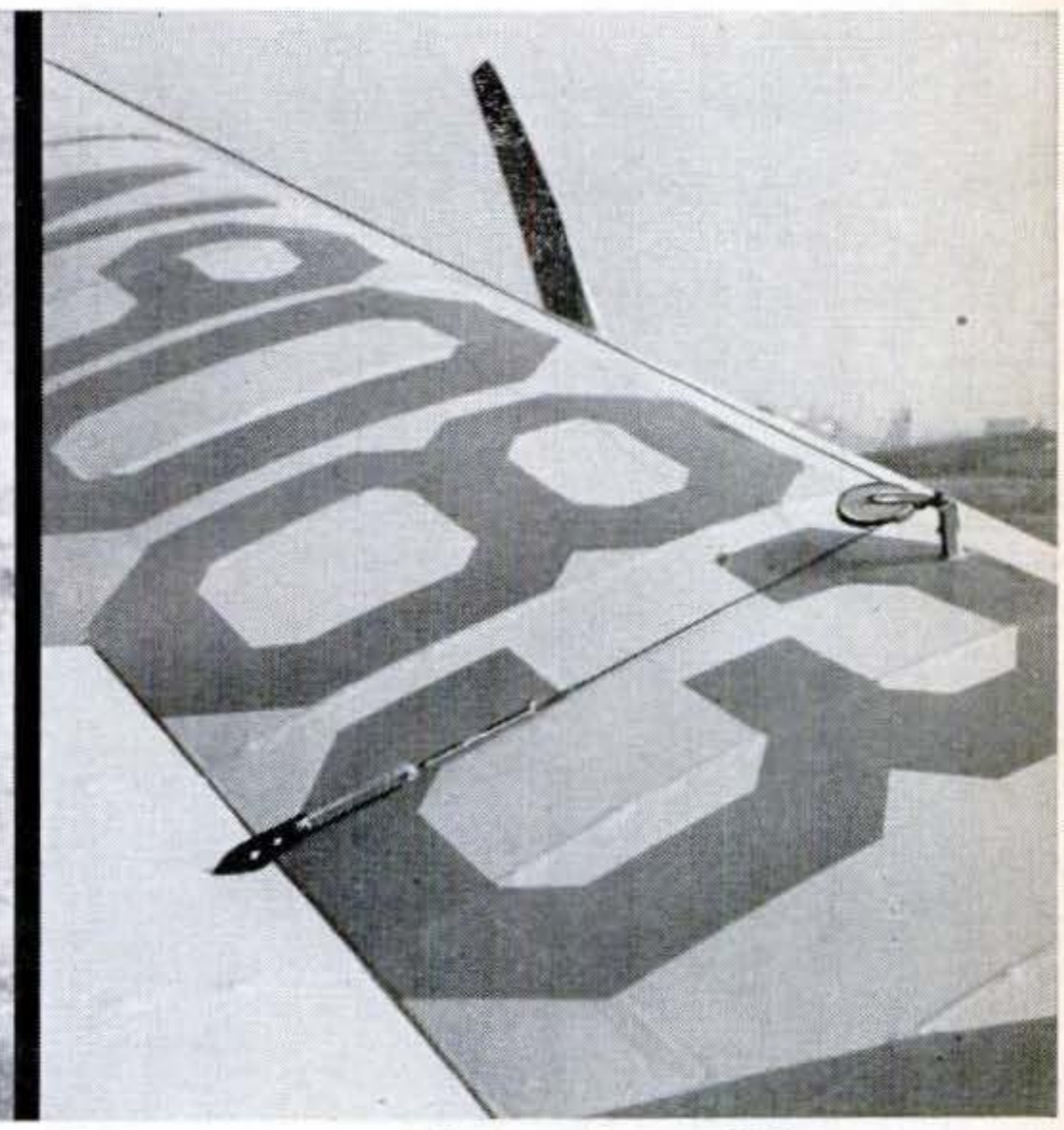
**Hauling plane** to warm-up ramp requires little effort. Builder pulls it along by tail wheel.

**While White spins prop,** his wife, Vivian, handles throttle. He cut 9 inches off ends of standard 67-in. prop so tips would clear ground.

**Plane rolls** on 7 by 16 tires salvaged from an old Aeronca. Its landing speed is only 35 m.p.h. Engine is 40 hp. Plane's height is 64 in.




**Stabilizing and control surfaces** on midget plane are unusually large for its size. Stabilizers are bolted to fuselage wood structure.



**For economy and simplicity,** White mounted his control cables to ailerons on top and bottom of wing, led through standard aircraft pulleys.



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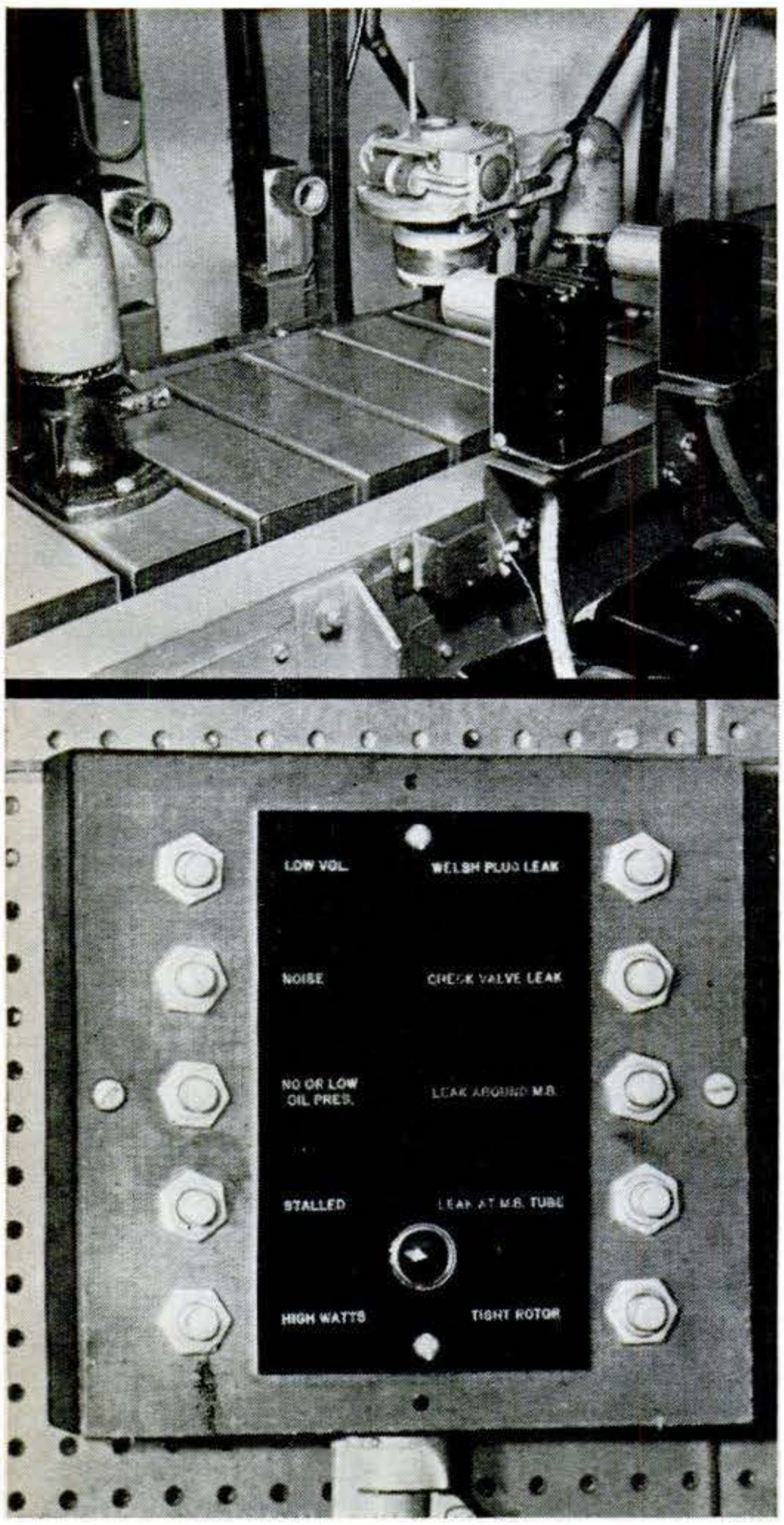
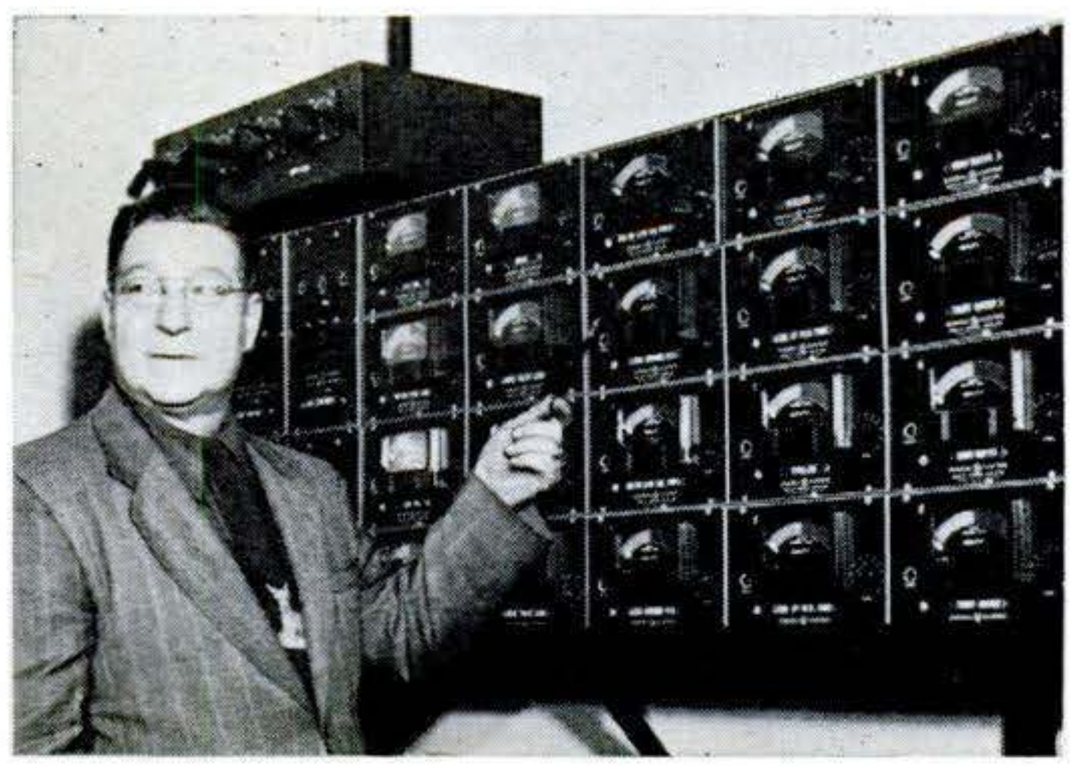
# "Brain" Locates Trouble




An electronic brain now watches over the assembly line at the GE refrigerator plant at Erie, Pa. When something goes wrong, the brain warns the production boss by moving pointers from green to red.

Electric eyes (top left) count every unit produced. When an inspector finds a faulty one, he pushes one of 10 buttons (bottom left) corresponding to the cause for rejection. The brain (bottom right) keeps constantly comparing the number of rejects for each cause with the total number of units produced. When the proportion of rejects for any one reason becomes abnormally high, a pointer moves from green to red, indicating that the trouble is more than simply chance defects.

Formerly, production figures were analyzed manually, requiring many hours—while bad units were made. Now the trouble can be found as quickly as it occurs.



## Radiation Detector Spots "Hot" Hands and Feet

When atomic workers see a red light on this machine, they stop. It's a new RCA radiation detector that flashes red, yellow, or green lights to tell how much radioactivity it finds on hands and feet.

All the worker has to do is step on the platform and place his hands in openings at the sides of the machine. Pressing his hands on plates inside the openings switches on Geiger counters that start measuring the radiation. Registers, in addition to the lights, record the exact measurement.

The machine simultaneously measures the amount of both beta and gamma contamination, while at the same time automatically compensating for background radiation.



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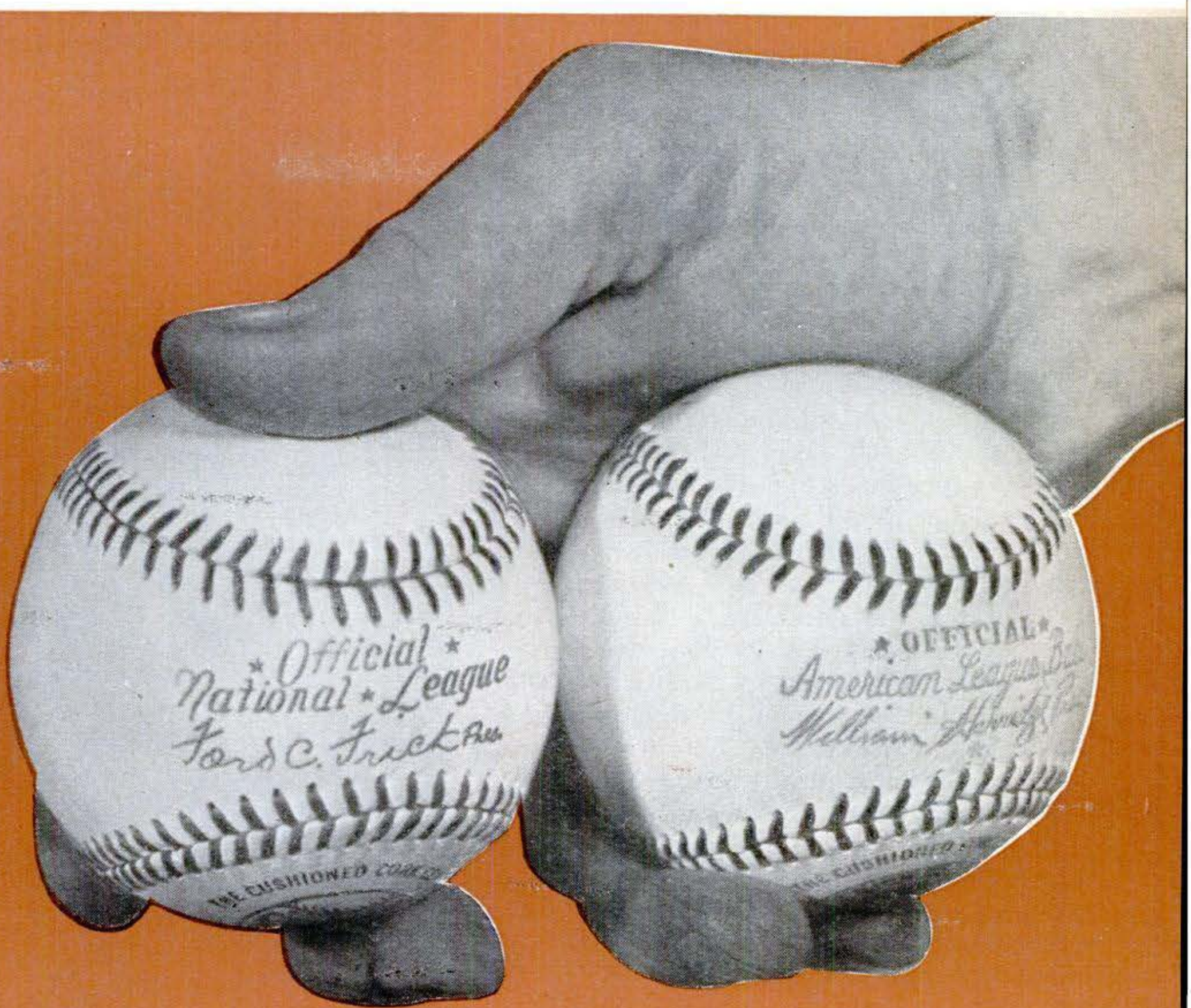


# Inside Story of Baseballs

**Are they getting livelier? Do the two leagues use different balls? How are they made? Here are all the answers.**

***By George H. Waltz, Jr.***

*PS photos by Hubert Luckett*

EVERY time a big-league umpire barks his familiar "Batter Up!" this spring and summer, the pitcher will be hopefully fingering one of many thousands of dozens of official baseballs that will see major-league service during the season. On these balls will ride the hopes of sluggers and hurlers alike.

Is the 1950 official ball livelier than the ball used last year, or the year before? Is there any difference between the National and the American League balls? What goes into the making of a big-league ball?

These were some of the questions that PS photographer Hubert Luckett and I wondered about as we headed the PS prowl car for Chicopee Falls, Mass., to visit the new streamlined plant of A. G. Spalding & Brothers. Spalding makes *all* major-league baseballs—and has made them ever since the two big leagues were founded.

The first thing we learned at the big, modern sporting-goods factory was that the big-league ball, despite newspaper sports stories and popular belief to the contrary, is no different today—no livelier, no



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deader—than it was before the war. Stringent scientific manufacturing and testing methods have kept it that way. During the war years, the ball was a bit deader than normal due to restrictions on the use of rubber and other materials. Since the war, however, the ball has been built to the same rigid specifications as the ones that made Babe Ruth the "Home Run King" and Walter Johnson the dean of pitchers.

We also learned that the only difference between an American League ball and a National League ball is the label printed on it—a blue Reach label for the American League and a black Spalding imprint for the National League. Both come from the same bin. Spalding bought up the Reach company and its trademark 50 years ago.

In the manufacture of a major-league baseball, little is left to guesswork. The rules of the game itself set down close tolerances. A big-league ball by definition—and that includes the one you buy over a sporting-goods counter—must measure in circumference not more than 9¼ in. and not less than 9 in., and weigh not more than 5¼ oz. and not less than 5. Even the types of inner windings are specified. Which means careful inspection of all raw materials and rigid standardization of work.

### *Balls with "Built-In" Home Runs*

A major-league baseball starts out as a carefully selected assortment of cork, rubber, wool yarn, cotton thread, rubber cement, and horsehide. It ends up as a rugged sphere that, when hit at just the right angle with just enough force to give it an initial velocity of 155 feet per second (approximately 105 m.p.h.), will travel about 420 feet on the fly—which means a home run in just about any man's ball park.

The famous "cushioned cork center," the heart of the big-league ball for 20 years, consists of a marble-size pellet of cork composition clothed in two semispherical black rubber cups. These are fitted against a central gasketlike red rubber ring and completely enclosed in a special molded-rubber casing. On top of this cork-and-rubber center, automatic machines carefully wind, in succession, 121 yards of one type of gray wool yarn, 45 yards of another type of gray yarn, 53 yards of still another type of cream yarn, and finally an outer winding of 150 yards of fine white cotton.

The winding is so important that the winding room is maintained at a constant

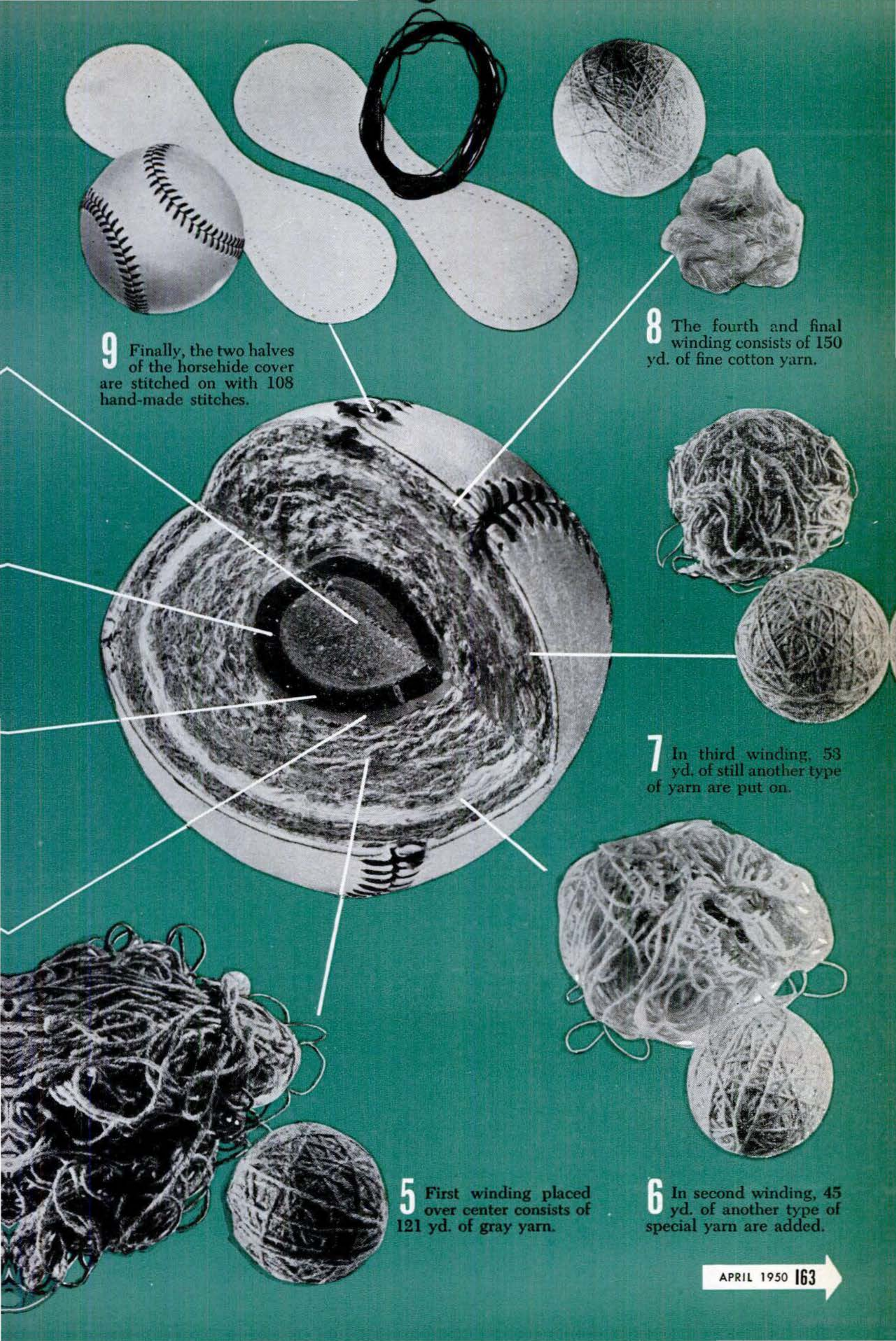
## *The inside of a baseball*

**1** Start of a baseball. Cork composition is molded into a sphere.

**2** Then two halves of hollow rubber sphere are molded.

**3** These, together with gasketlike rubber ring, form cover for core.

**4** Second rubber covering completes the cushioned-cork center.



**9** Finally, the two halves of the horsehide cover are stitched on with 108 hand-made stitches.

**8** The fourth and final winding consists of 150 yd. of fine cotton yarn.

**7** In third winding, 53 yd. of still another type of yarn are put on.

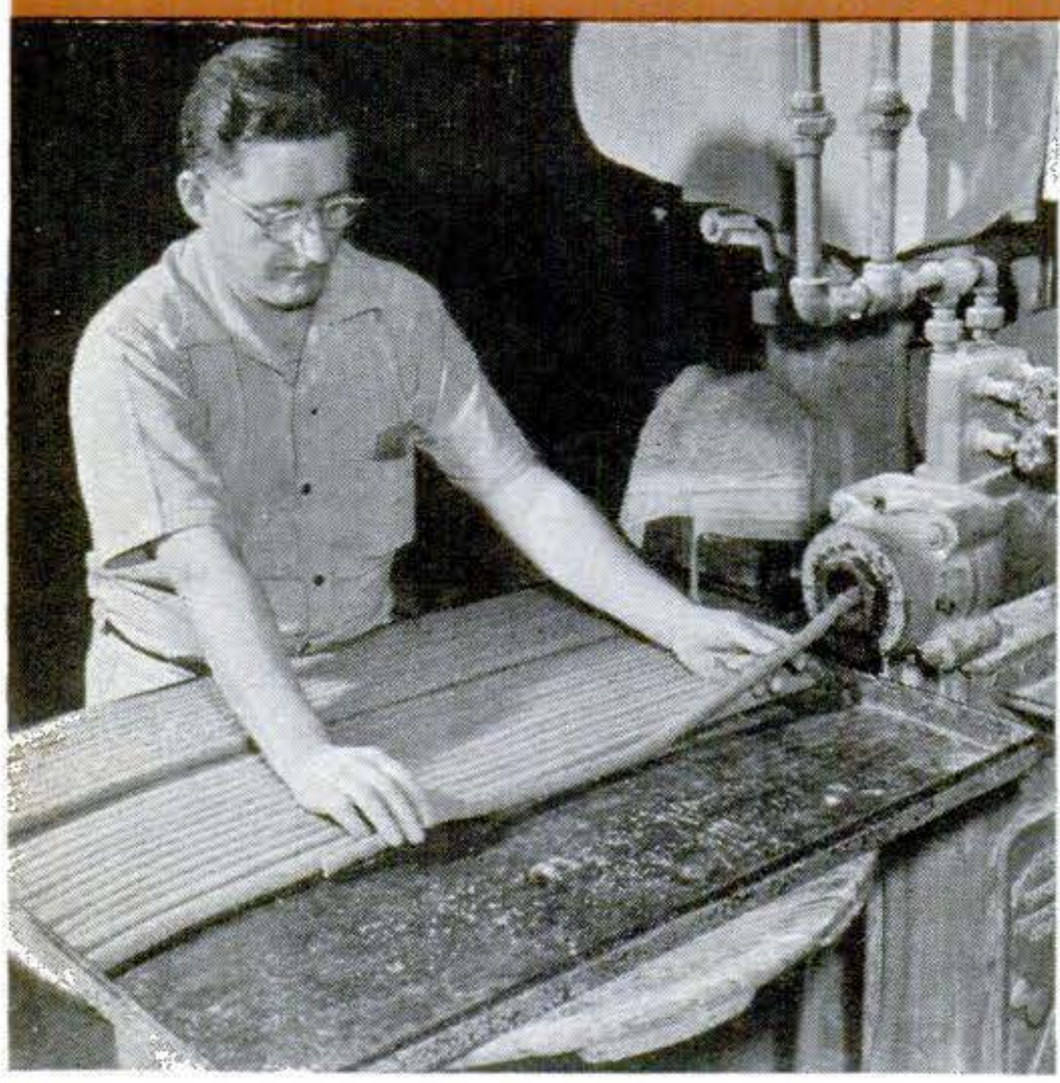
**5** First winding placed over center consists of 121 yd. of gray yarn.

**6** In second winding, 45 yd. of another type of special yarn are added.

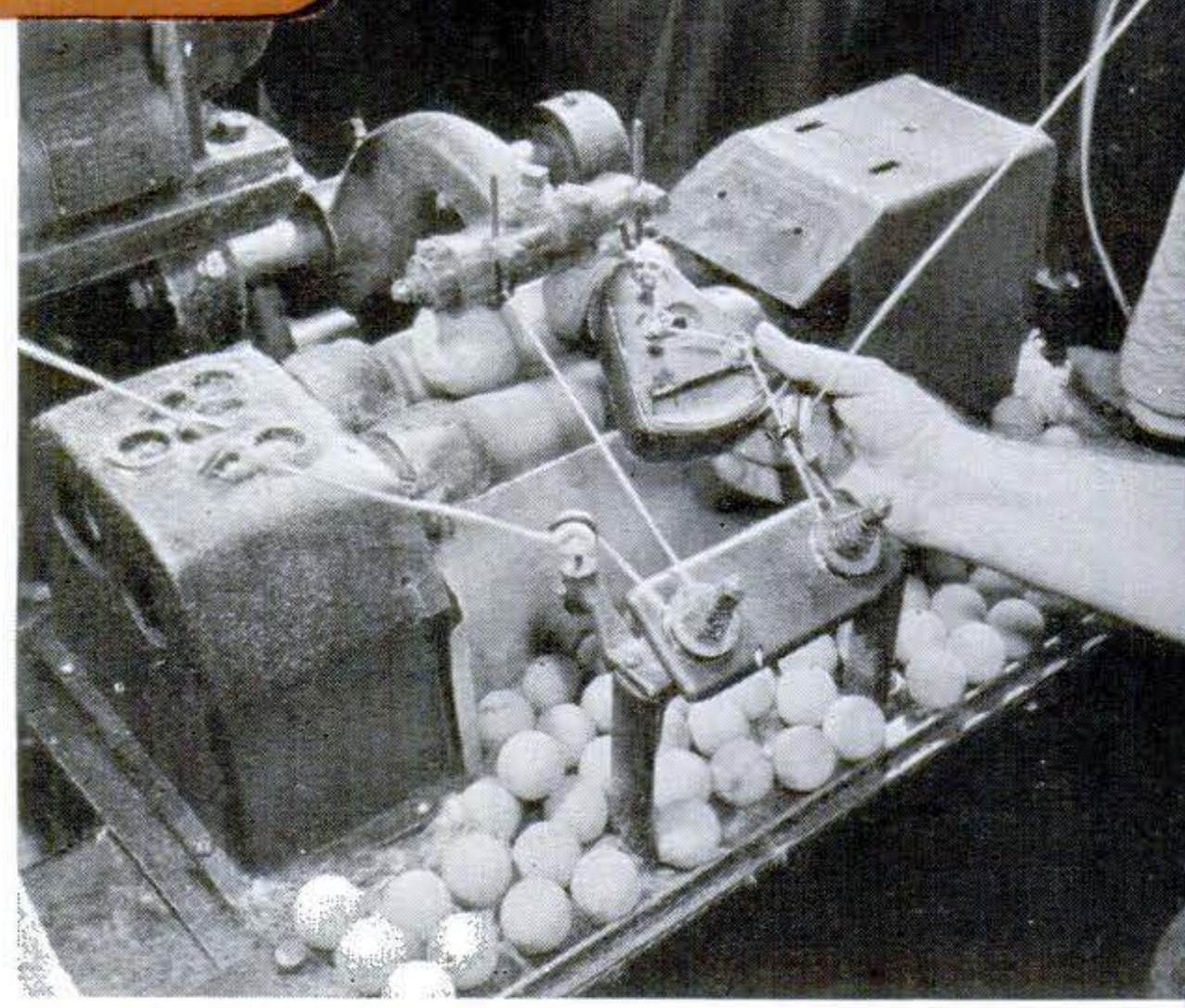
temperature and humidity, and the tension of the yarns is checked periodically with a portable tensometer. Any deviation would produce balls whose windings were not uniform. Loose windings would mean a deader ball; tight windings, a livelier ball.

After the final winding, the balls are given a quick dip in a rubber-cement bath to bind the outer layers together. Then they go to the stitching room. There, the two hourglass-shaped halves of the horsehide cover are sewed on by hand with 108 carefully placed stitches. Girls do most of this work—so far there are no machines that

## How a baseball is made

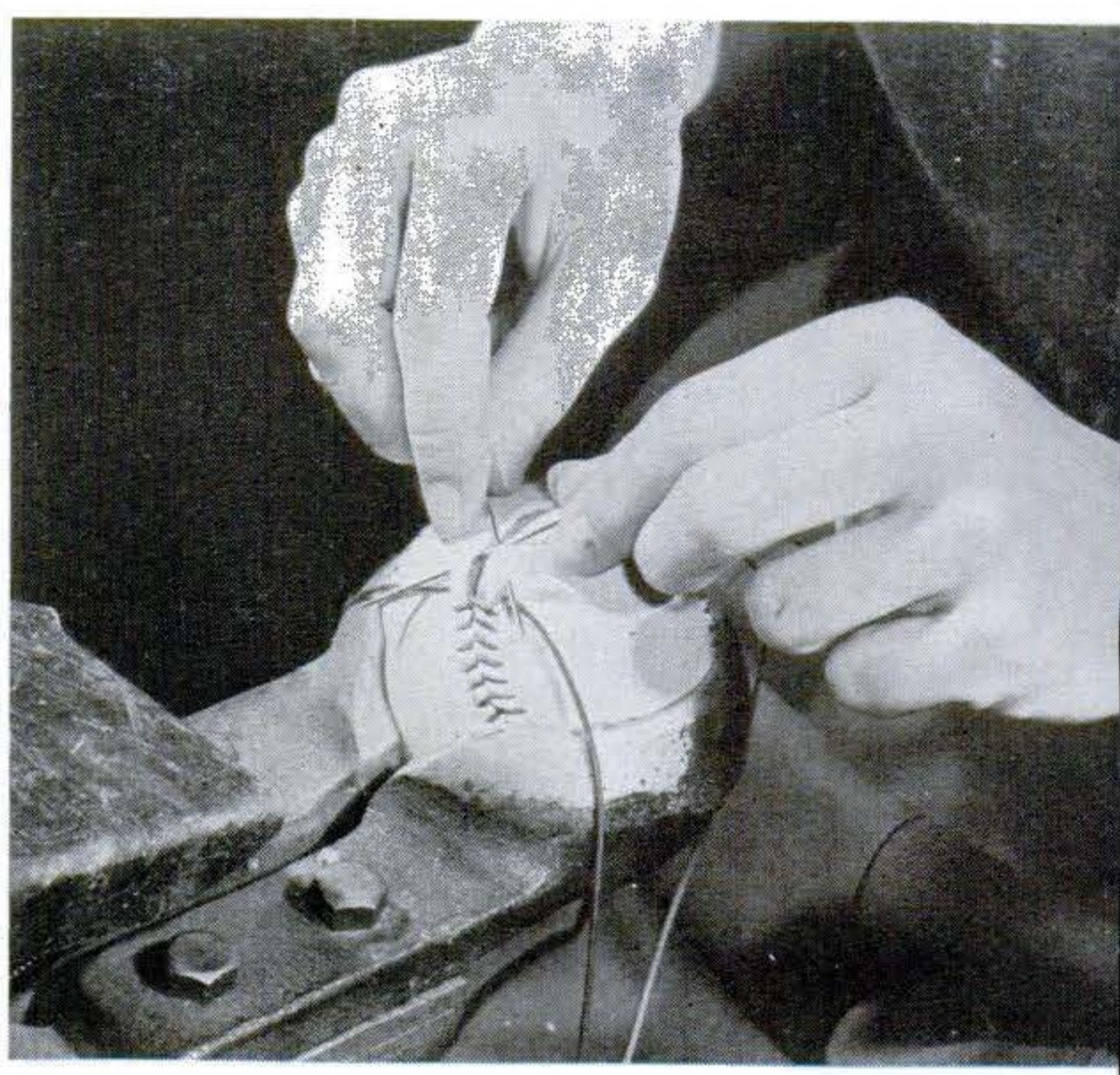


**Extruding the cork** for the marble-size cores of the famous cushioned-cork centers. The sausagelike strips are first cut into short slugs and then molded into spheres.



**Winding the ball** with various yarns is done on automatic winding machines. Because tension is important to make balls standardized, it is checked often with tensometer.

**Weight and size are important.** After final cotton winding, balls are checked for weight on scale, and for size with maximum (right) and minimum (left) ring gauges.



**Covers are sewed on by hand.** Experienced stitchers, most of them women, can sew an average of about 40 baseballs a day. No machine has yet been devised to do the work.



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can duplicate the hand-sewed over-and-under cross stitch. The average stitcher can sew a ball in about 12 minutes, averaging about 40 balls a day.

The hides from 35,000 horses are needed to meet the yearly baseball-cover needs of Spalding alone, and getting good horsehide is a critical problem. They can't be the hides from ordinary range or dray nags. These are apt to be cut, bruised, and scarred and thus can't meet the rigid requirements for smoothness and uniform strength. In the early days of baseball, the hides of retired fire horses were used for covers. Later, when the gasoline engine replaced the fire horse and the demand for baseballs grew, prime horsehides were imported from France and Belgium. Today, however, practically all baseball covers come from the hides of well-cared-for domestic horses, most of which were used for medical purposes.

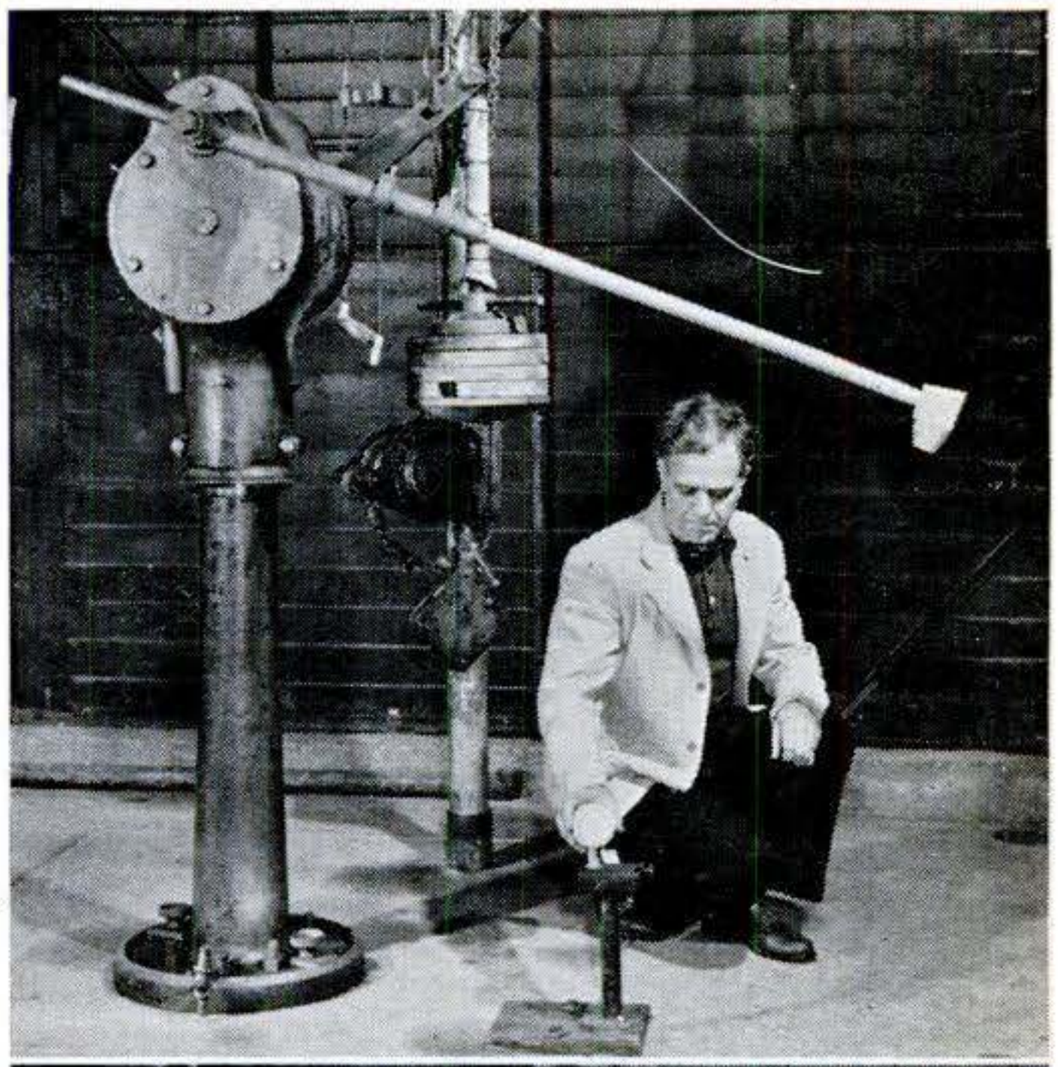
After the cover halves have been cut out, complete with the stitching holes, they are machine-split to a uniform thickness and then hand-graded according to grain, texture, and color. Each half must match the other half, not only in appearance but in grain structure and strength. The matched halves are then thoroughly moistened and stapled loosely in place on the ball before it goes to the stitchers. By stitching the covers on while damp, a tighter final fit is obtained when the leather shrinks back to size.

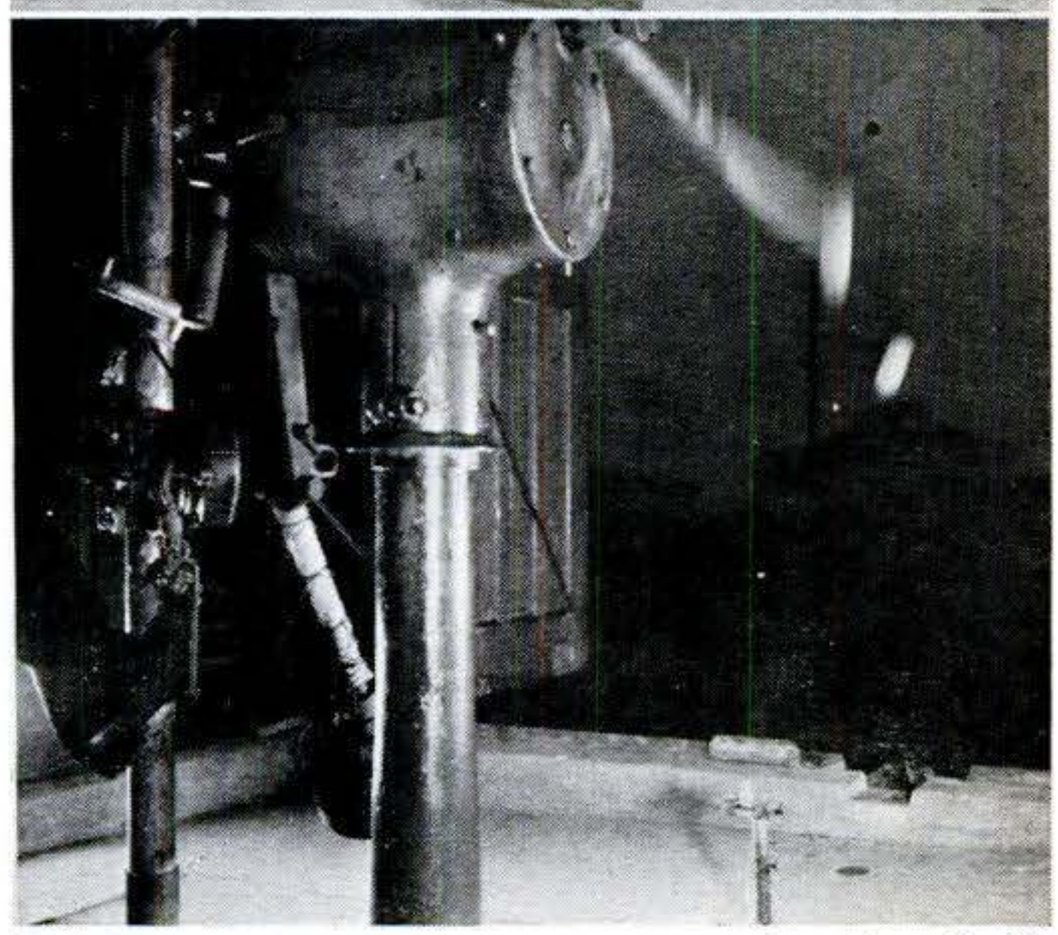
### *Mechanical Sluggers Test Balls*

As the big-league balls roll off the production line, sample balls are removed periodically for testing. A mechanical batter housed on a test field back of the plant wallops out homers with a standardized force to check a ball's pep and carry—giving it more wear in a few minutes than it would get in dozens of innings. The balls slugged out while I watched all landed within a few feet of each other.

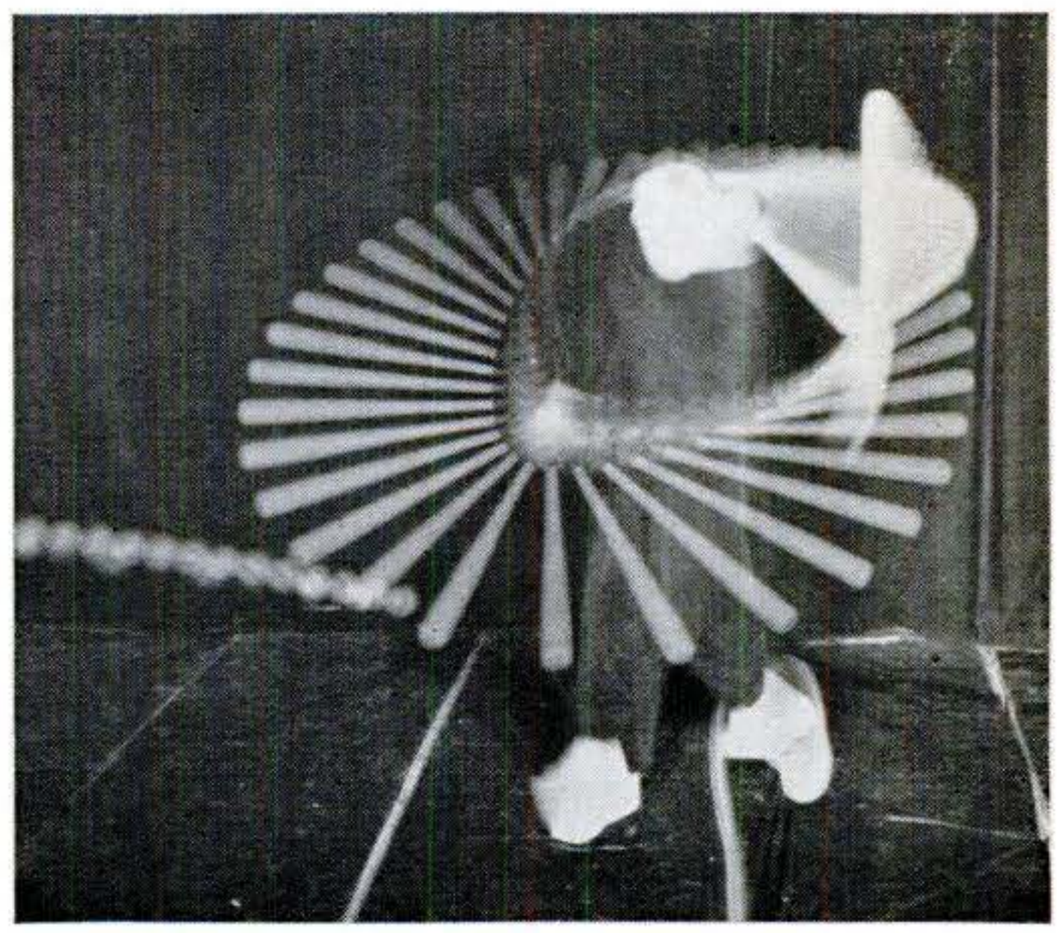
In the laboratory, ingenious torture machines measure a baseball's ability to take it. An air gun fires balls at a test panel with many times the impact they would receive with a home-run hitter's bat. A drop hammer literally hammers a ball to see just how much squeeze it can take.

Of one thing I felt absolutely sure when we had finished—big-league baseballs are as standardized as it is physically possible to make them. I'm going to remember this when some player or fan raises the perennial cry about the "livelier ball." END





**Mechanical home run king.** This baseball-testing machine can hit a homer every time it swings. Falling weights (in rear) rotate arm to smack test ball with desired impact.



**"Dixie" Walker's swing** as it looks to a camera under stop-action lights. From such photos, baseball makers can figure out what initial velocities and impact forces are acting on balls.



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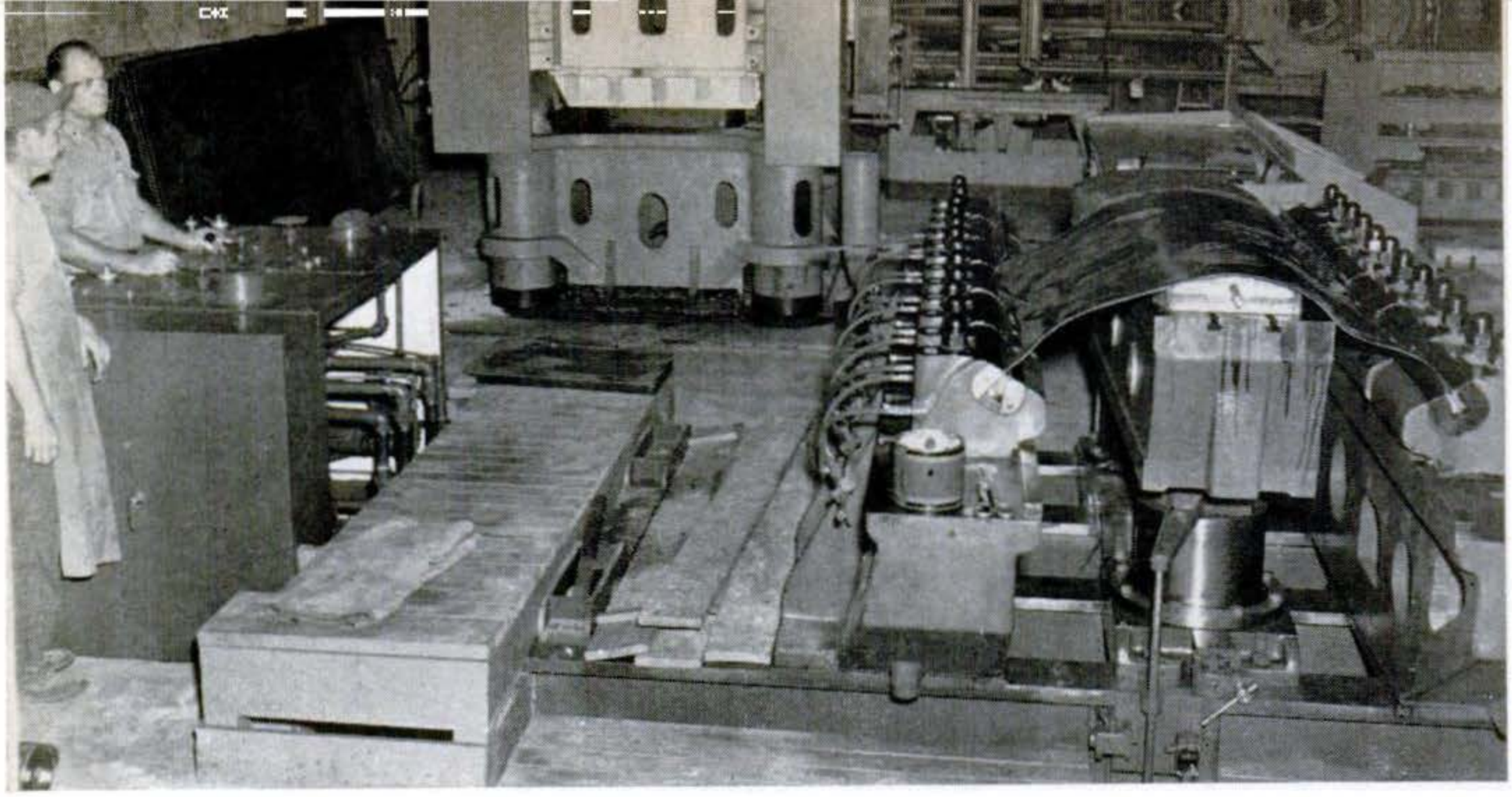
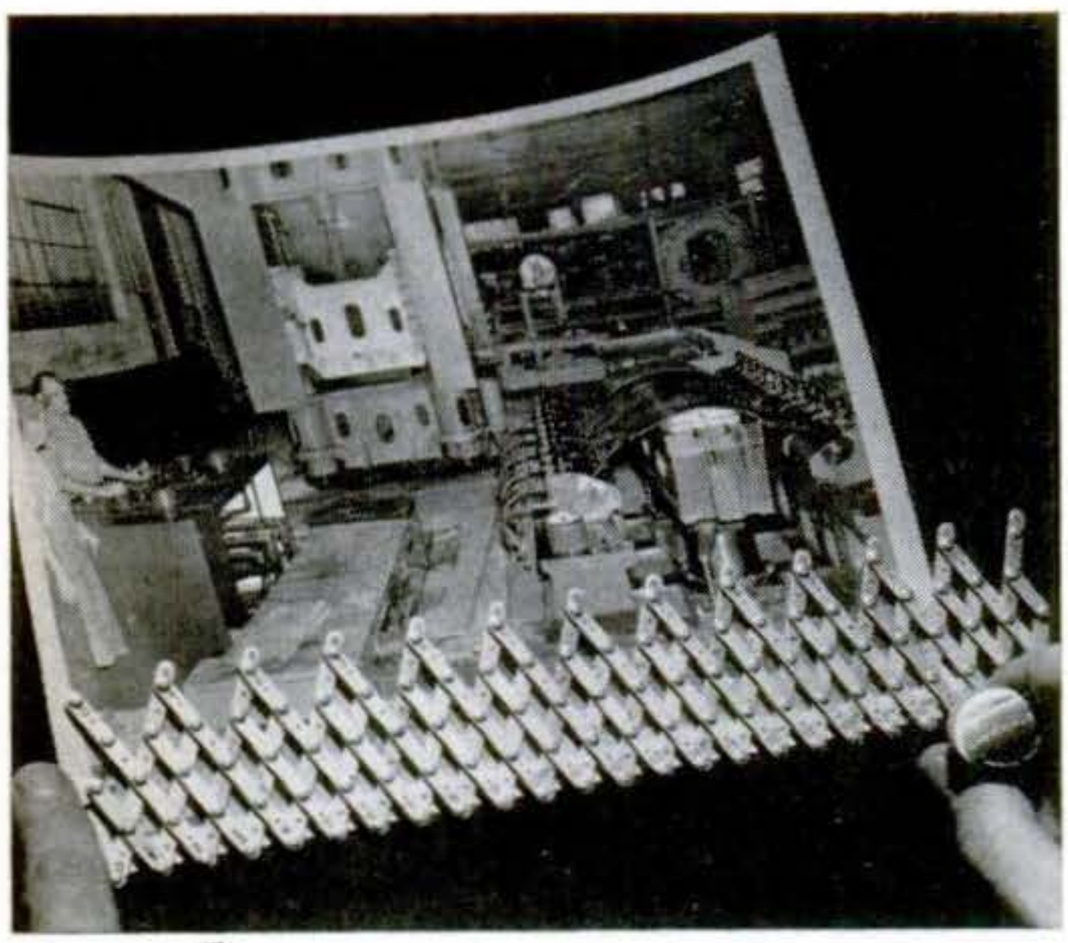


## Stretching Metal Paper-Thin

LATEST trick of the Marine Corps air-station shop at Cherry Point, N. C., is stretching cold sheets of steel or aluminum over metal molds to shape them for aircraft parts. If necessary, they can be stretched paper-thin. An alloy casting of the part to be made is secured to a vertical hydraulic ram (right center above). Sheet metal is held taut above it by air-operated clamps. Then the ram rises, stretching the metal.



## Expanding Rule Scales Photos

A NEW flexible ruler is shown being used by a PS artist to scale down the photo reproduced at the top of this page. The ruler, made like a folding gate, is calibrated in "inches" that stretch as it is extended. Here, the artist wanted a printing plate 5⅛ in. wide and 2⅞ in. deep, using the full width of the picture. So he pulled out the ruler until 5⅛ of its "inches" spanned the 10-in. width of the photo, as shown. Then, keeping the ruler rigid, he measured off 2⅞ elongated "inches" from the bottom of the photo. This showed where it had to be cut off at the top to make a plate actually 2⅞ in. deep. The device, called Linkrule®, was invented by Paul Broner, of the *Detroit Times*.

## Fork Lift for Balcony

THE familiar fork lift has gone in for a two-way stretch. The Towmotor Corp. of Cleveland has announced the production of an elevator fork lift that will reach down to a first-floor production line and fetch a ton of materials up to a balcony storage area. Above, one Towmotor is lifting another one just to show depth of operation.



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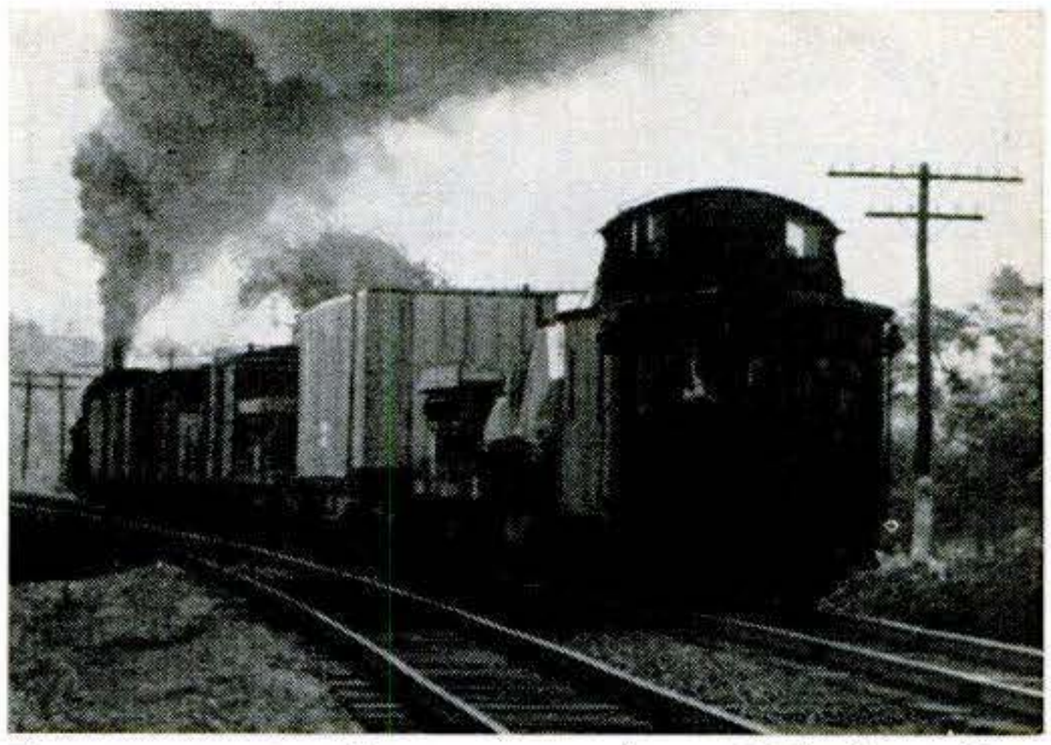
# Train Hauls Train Engine

LOCOMOTIVES haul all kinds of things with no trouble. But when the locomotive itself has to be shipped, it's a problem.

The pictures on this page show how General Electric wrapped up a giant electric engine destined for the State Railways of Chile. The body, lifted off the trucks and crated, took up three flatcars. The trucks were divided into two sections, covered, and shipped on two other flatcars.

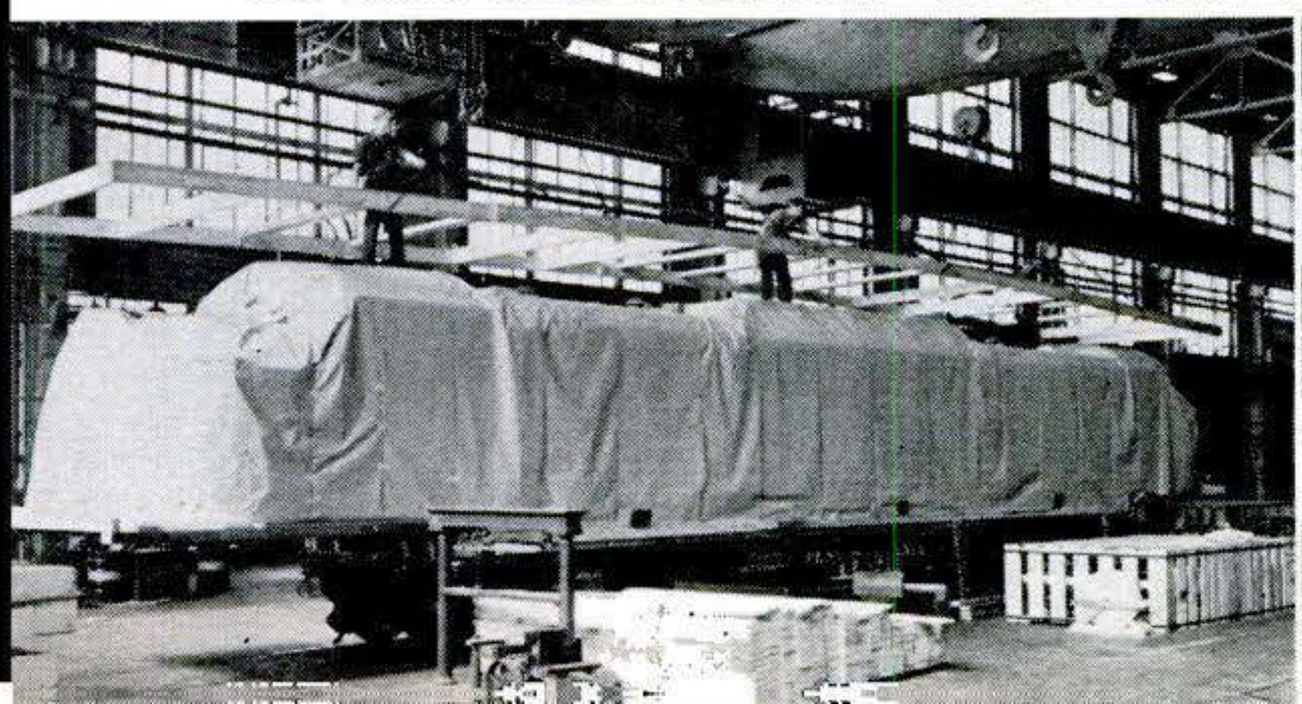


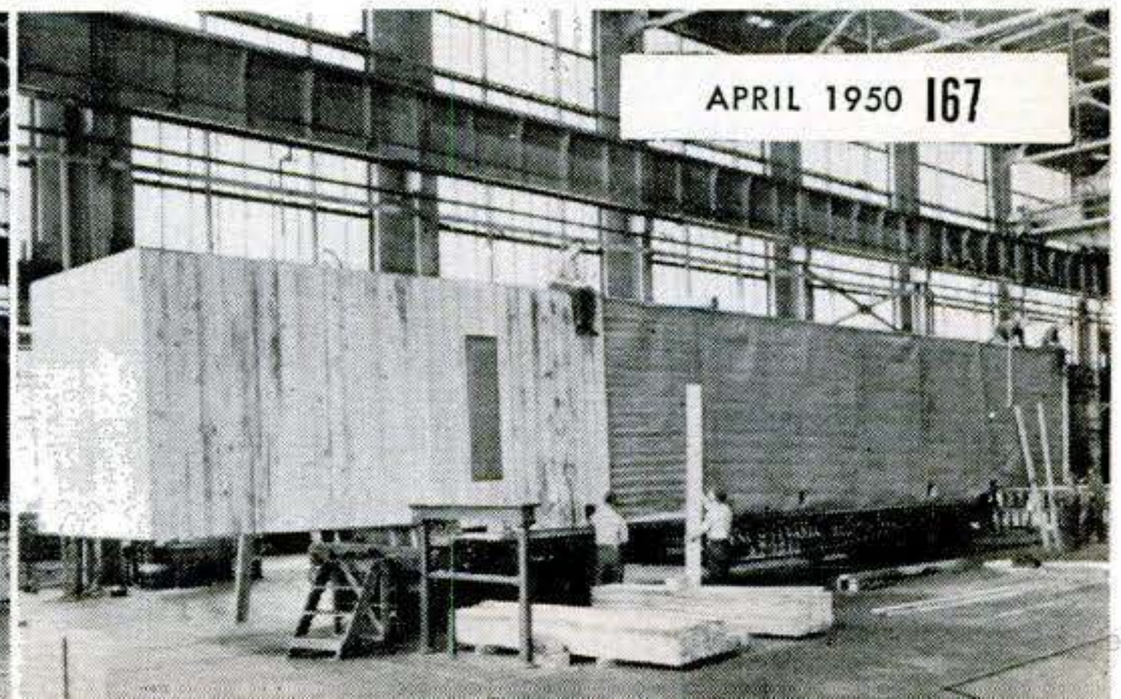
**Train carrying locomotive** from GE's Erie, Pa., shops to New York City docks for ocean voyage to Chile had to follow special route, chosen for its shallow curves and ample clearances.

**The locomotive body** was too long to fit on one flatcar, and two other flatcars were later moved up to support overhanging ends. Crating was completed after body was lowered onto this car.

**Once in place on the flatcar,** the locomotive was covered with insulating paper, then the framework shown below was set in place, and the whole thing wrapped in waterproof paper.

**Final step** was building a crate around the body. This required 15,000 board feet of lumber —enough to construct six ordinary-sized rooms. More lumber went into covering for the trucks.

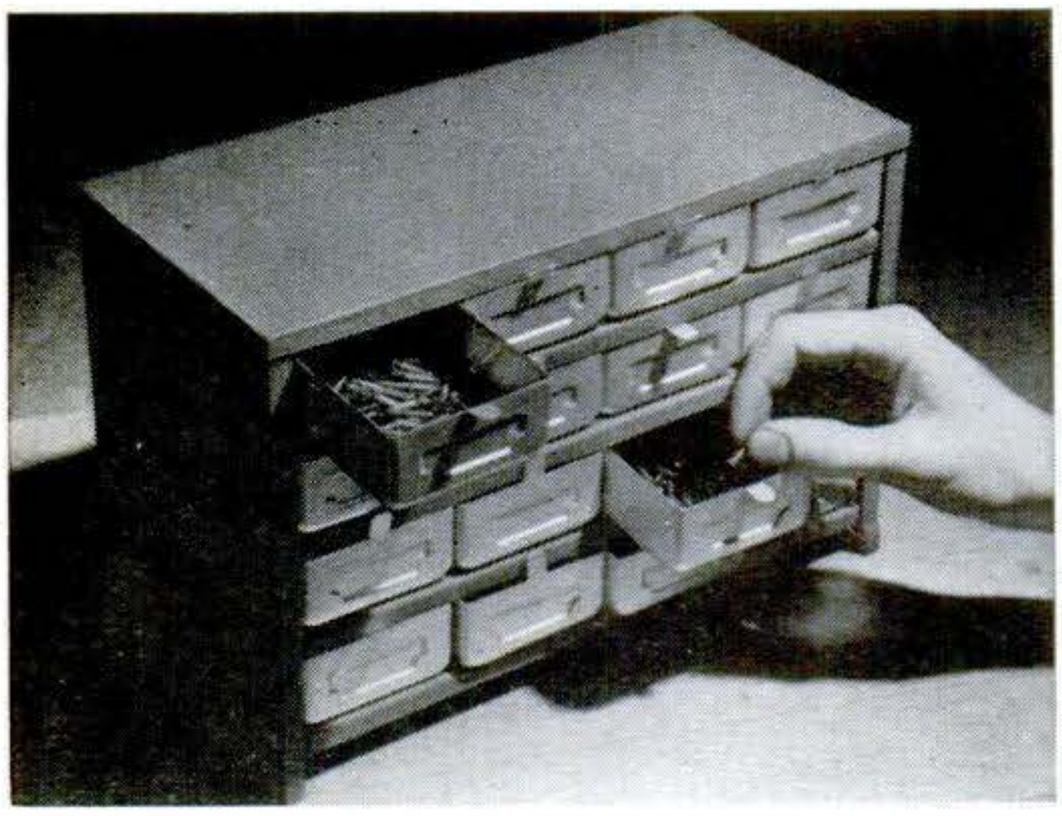




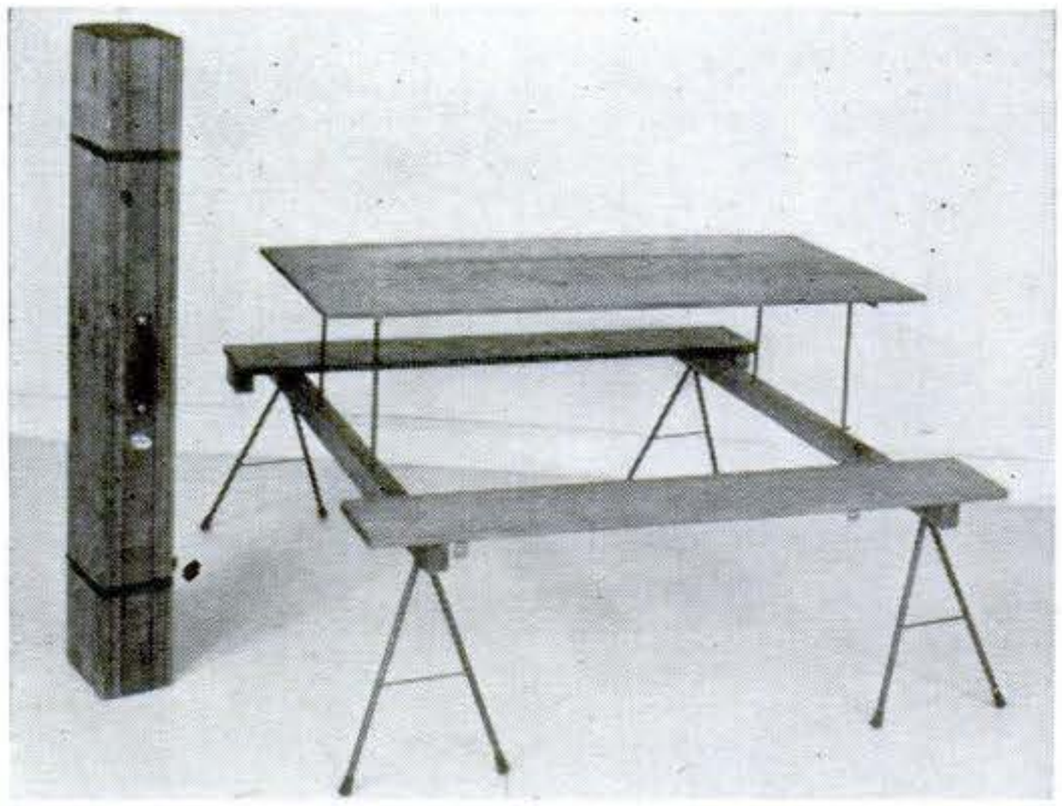
# Aids to Modern Living

**Sews Without Attachments.** When a housewife wants to make buttonholes, sew on buttons, or embroider, she simply twists a dial on this German sewing machine. The mechanism rotates instead of oscillating, reducing wear. The front provides a chair with drawers. A. C. Weber & Co. distributes the Pfaff machine.

**Hamper Fits Under Wash Basin.** The enameled-steel hamper above lets you store soiled laundry under the bathroom sink. Sliding guides along its sides at the top and thumb screws in its base permit it to be fitted under basins of different widths and heights. Made by the Star Cabinet Co., Bayside, N. Y., it sells for about $14.



**Chest Stores Small Parts.** Nails, screws, and other shop materials are easy to get at when kept in this 16-drawer metal cabinet. Its aluminum drawers have 32 removable compartment dividers. Slots on the drawers hold labels. Tibbits Mfg. Co., Alliance, Ohio, prices the chest at around $5. Chests also come with 32 and 64 drawers.



**Portable Picnic Table.** This portable plywood picnic table can be quickly set up to seat six persons. Disassembled, the table and bench boards fit together to form a box to hold the detachable steel legs and fittings. The 38-lb. box will fit into a car's trunk. Jordan Welding & Mfg. Co., Cleveland, Ohio, sells the table for about $20.



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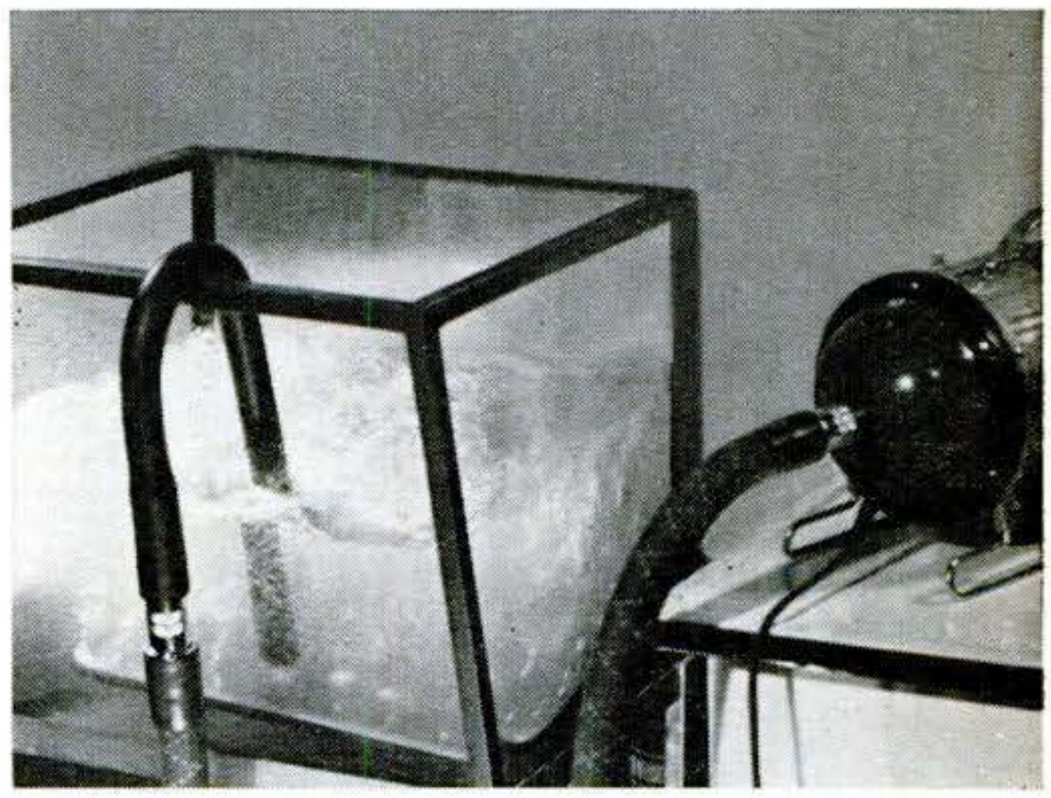
**Cord Kept Out of Way.** The metal rod clamped to the ironing board above keeps the iron's cord out of the housewife's way. The cord clips to the top of the rod and plugs into a socket at the base of the attachment. A separate cord leads from the rod's base to the wall outlet. Proctor Electric makes the Cordminder®.

**Stove Resembles Desk.** This new Westinghouse electric stove is designed like a desk so that a stool or wastebasket can be stored under one end. The Rancho® is 38 inches wide and has four burners on top, a work surface, and a full-size oven. A U-shaped, chrome-plated tube supports the range's open end. The price is about $160.

**Container Keeps Coffee Hot.** Coffee and other liquids stay hot until served in this heat-resistant glass container. Its base is shaped to fit right into a coffee cup, warming the cup and keeping the coffee from spilling. Made by the McKee Glass Co., of Jeannette, Pa., the Coffee Hottle® holds two cups.



**Vacuum Cleaner Powers Washer.** An ordinary washtub becomes a clothes washer with this new vacuum-cleaner attachment. A perforated plate, it is placed in the tub and connected to the cleaner. The air bubbles agitate the clothes, washing them. Snow White Washer Co., of Oakland, Calif., is the maker.



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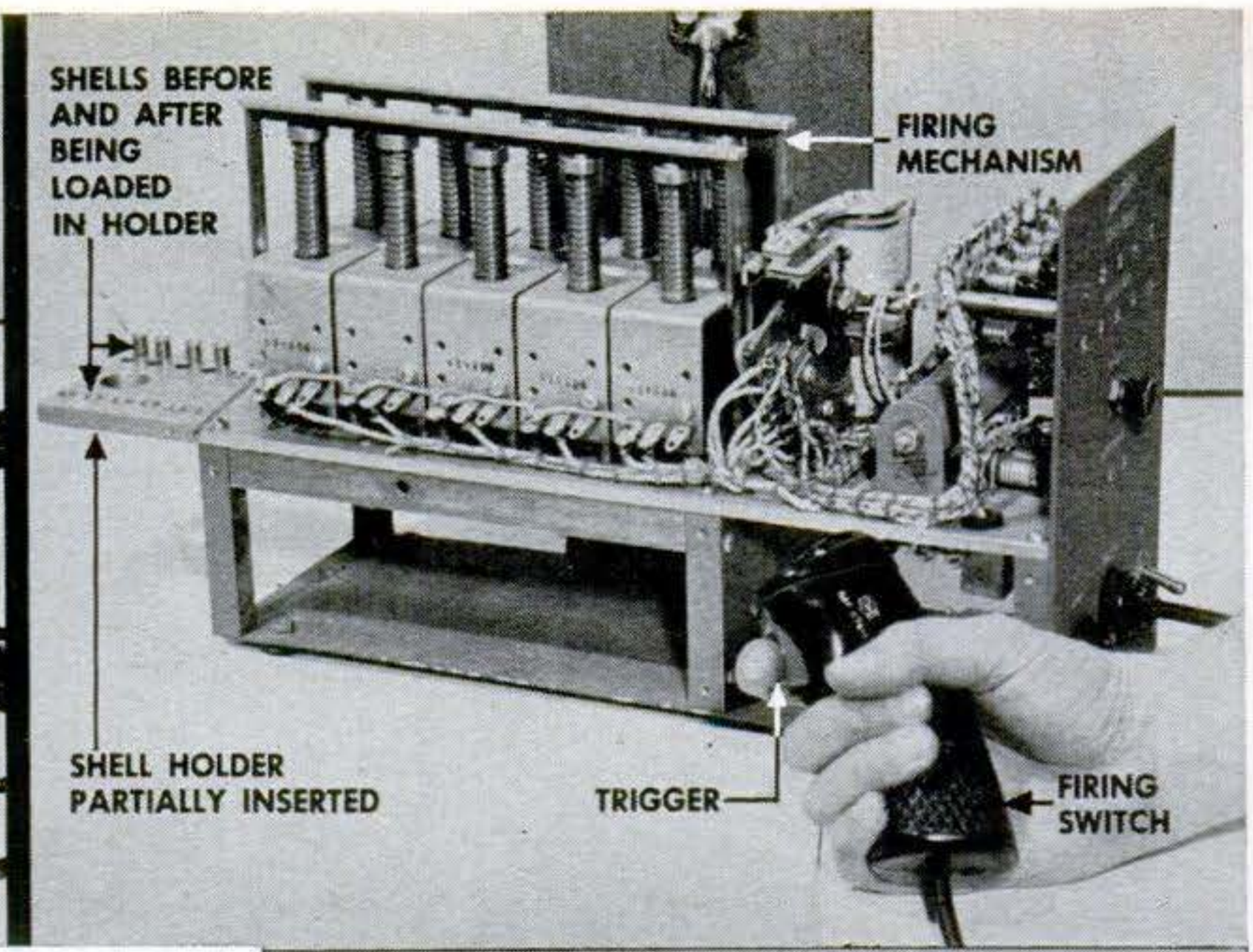
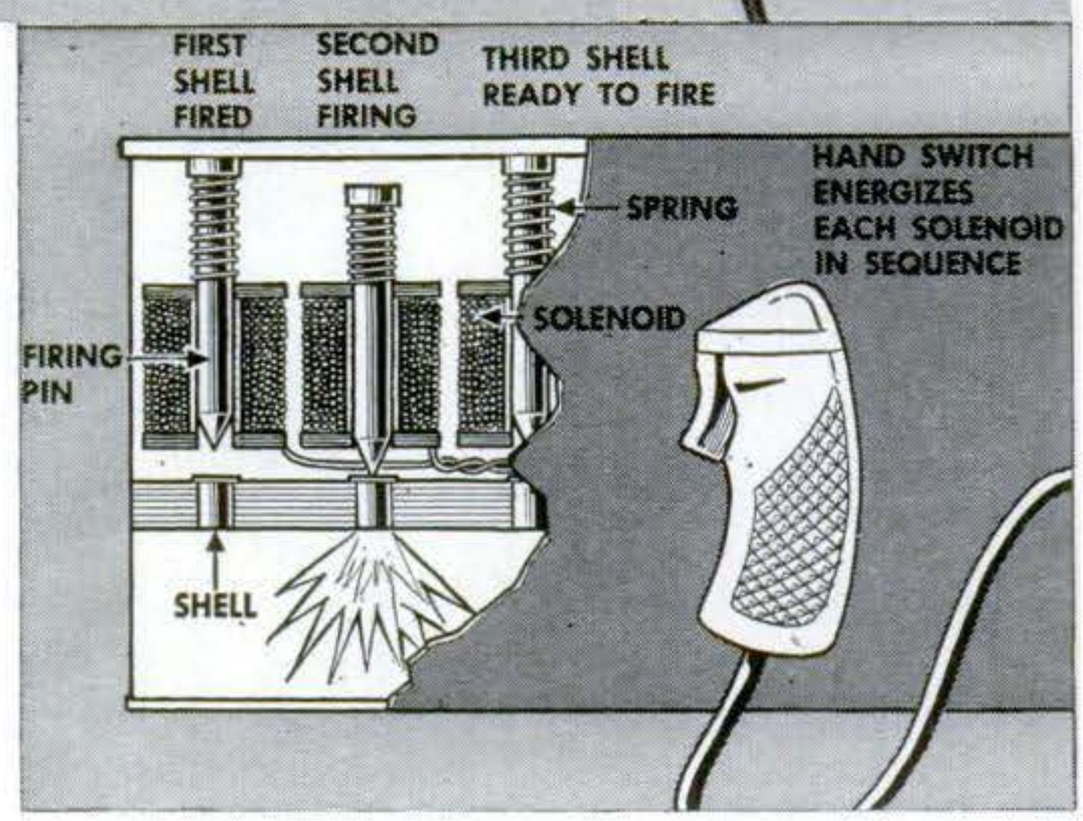


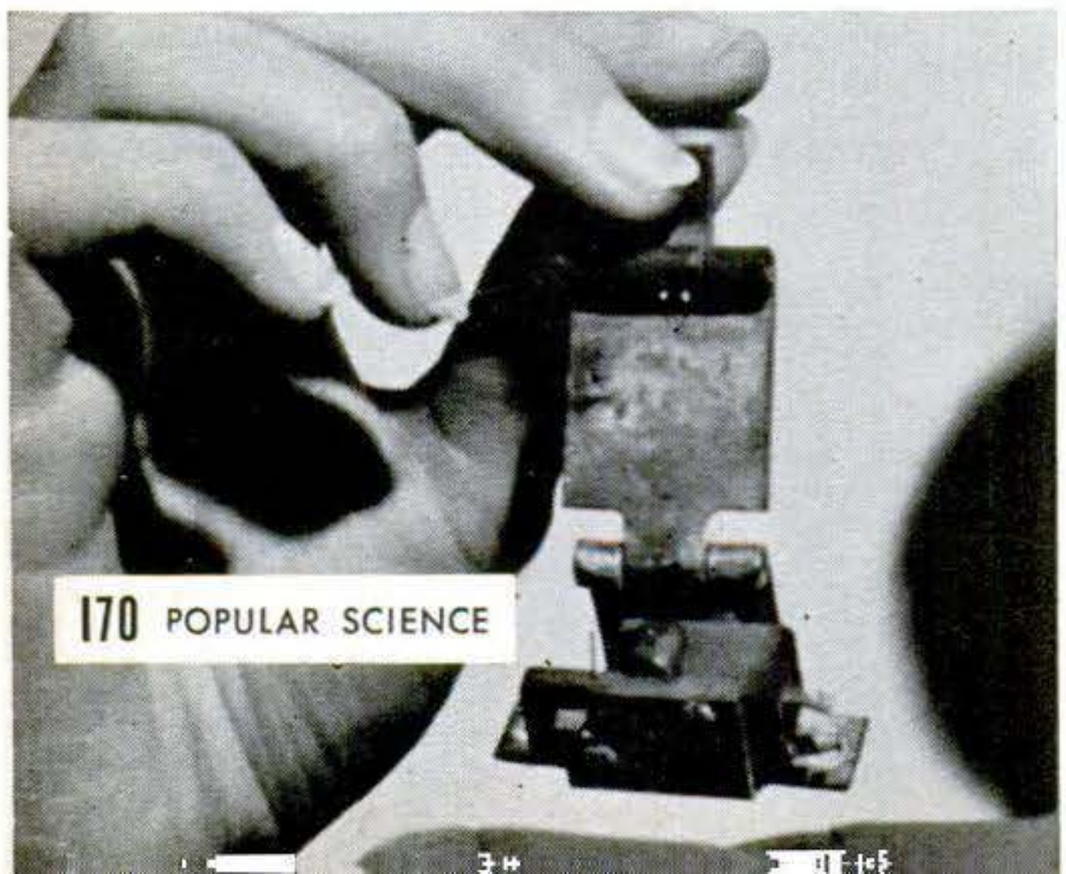

## Radio Gun Never Fails

THOSE gun shots you hear in WOR radio dramas come from this odd "electronic firing device." Sound-effects technicians designed it after the embarrassing experience of having a gun fail to fire when the hero pulled the trigger at the climax of a detective thriller. (He had to throw a knife instead.) Their new gadget is sure-fire, realistic, and safer than pistols firing blanks. The drawing at right shows how its trigger energizes a solenoid that magnetically depresses a firing pin, exploding a shotgun primer shell. Ten solenoids, automatically acting in turn, permit 10 shots to be fired in rapid succession. In case of a misfire, pulling the trigger again fires the next shell. The compact, portable device holds 30 shells in three holders that can be quickly shifted to bring each group of 10 into firing position. At present, 30 shots is enough for most WOR programs.



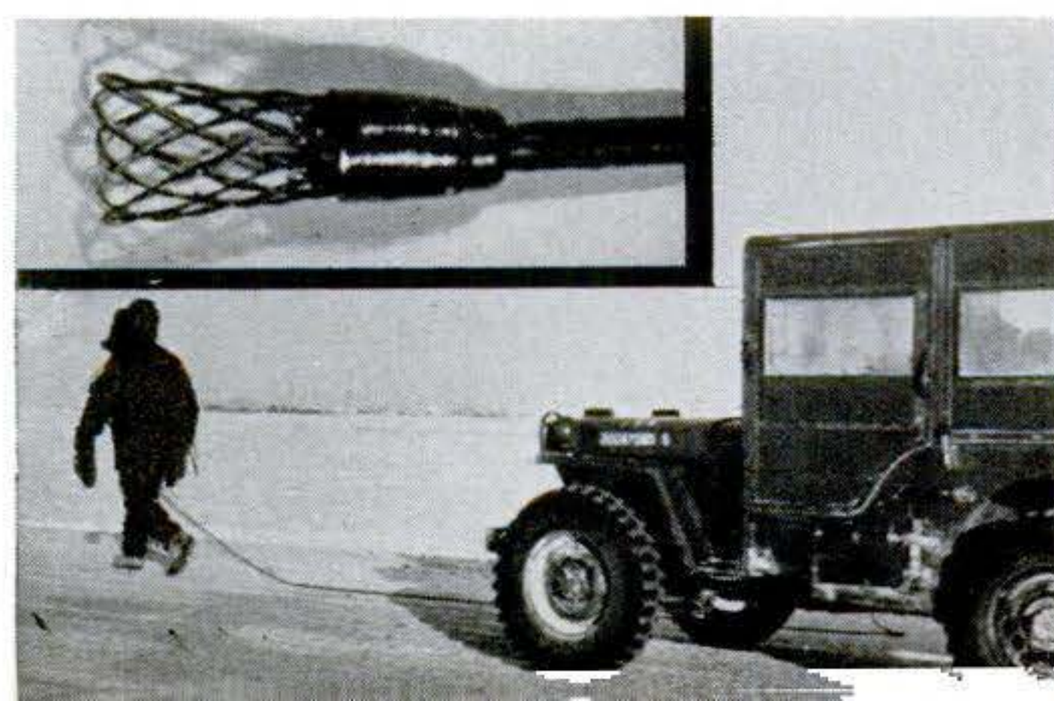

## Back from 250 Miles Up

ENGINEERS prize this charred and rusty electric switch as a souvenir of the Wac Corporal rocket that soared to a record height of 250 miles above White Sands, N. M., last year. The high-flying rocket, launched from the nose of a larger V-2 by the tiny switch at a 20-mile altitude, was first thought to have disintegrated into tiny particles upon reentering the atmosphere. Later its tail and the switch were found.



## Meter Tests Arctic Wear

ARCTIC fashions for U. S. soldiers are tested in the Far North with the new Quartermaster-devised Ventimeter, shown in use below. Since sweat-wet clothing leads to chilling and frostbite at subzero temperatures, the tests seek garments sufficiently ventilated to prevent overheating. Beneath their clothing, subjects wear a probe (inset) using a sensitive thermopile to translate air currents into electrical ones. A cable leads from the plodding subject to a following truck where a meter registers air movement in miles per hour.





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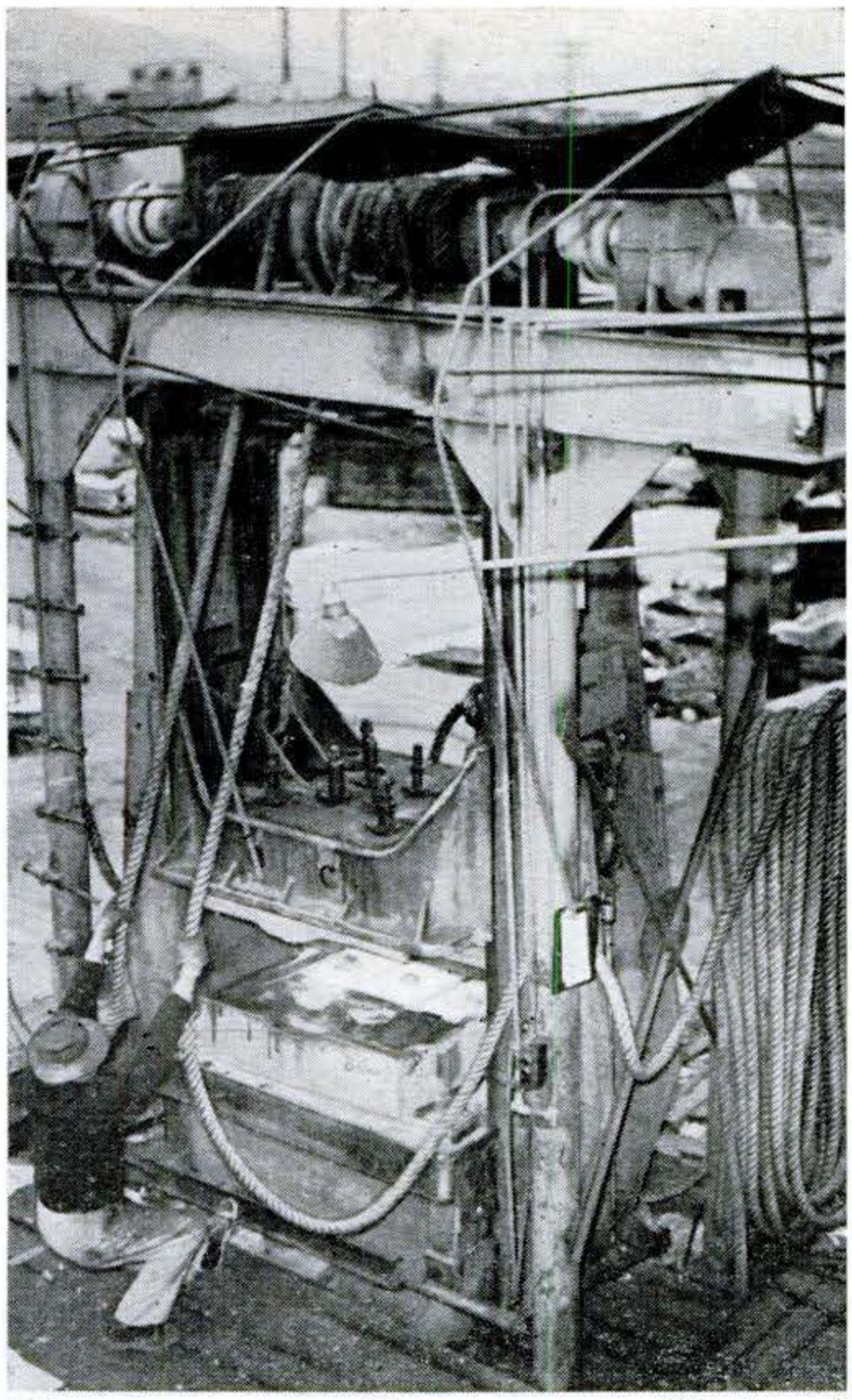


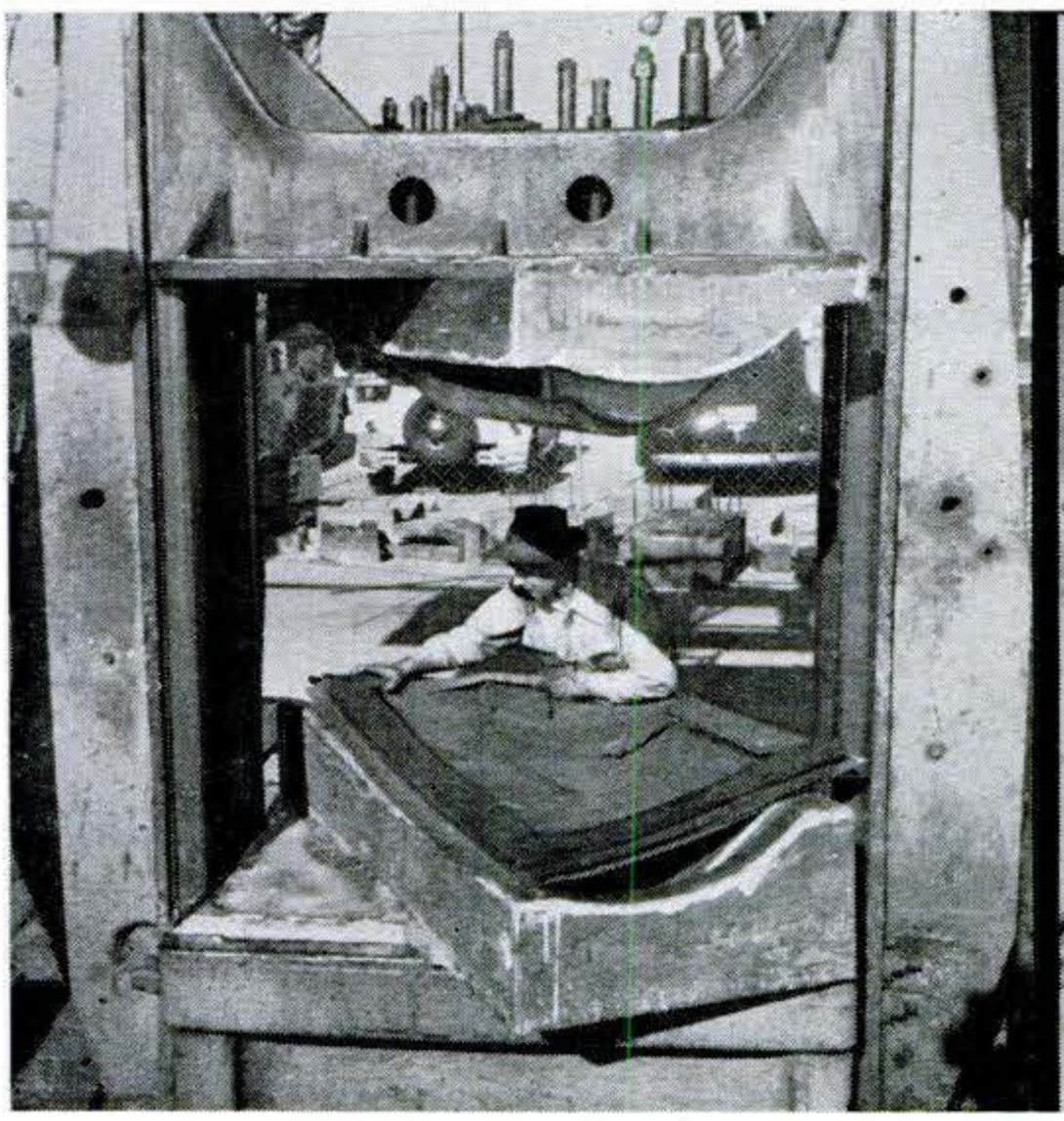
**When operator pulls ropes taut,** friction of revolving drum provides lift to raise upper die of "pile-driver" press above. Releasing ropes lets die fall to strike and shape sheet metal.

# "Pile Driver" Press Makes Auto Bodies

AN OUTDOOR drop hammer resembling an old-fashioned pile driver enables Stainless Steel Products, of Burbank, Calif., to custom-build bodies for cars and buses at prices ranging below $100. The gravity-operated press inexpensively produces auto-body parts, rocket-engine fittings, or kitchen pans by impact stamping, a process used by the aircraft industry during World War II.

Raised with a 15-hp. motor by ropes wrapped around a revolving drum, an upper die falls against a stationary lower one, shaping sheet metal placed between them. By his handling of the ropes, the operator varies the force of the blow as desired.

Unlike steel-jawed power presses for mass production, this press uses dies of comparatively soft metals—antimonial lead, and a zinc-aluminum-copper alloy called Kirksite. Dies of these easily melted and molded alloys cost only a few dollars to make. A single set lasts long enough to shape 5,000 auto parts, a small job for which steel dies would be too expensive. To see how they are made, turn the page.



**Metal to be shaped** is placed on stationary lower die while upper die with mating face is raised. Rubber around edge keeps metal from slipping under hammerlike blow of falling die.

**Impact of die** falling by gravity has formed auto-body part, being removed from press above, from flat metal sheet. To impart some complex shapes may take as many as a dozen blows.



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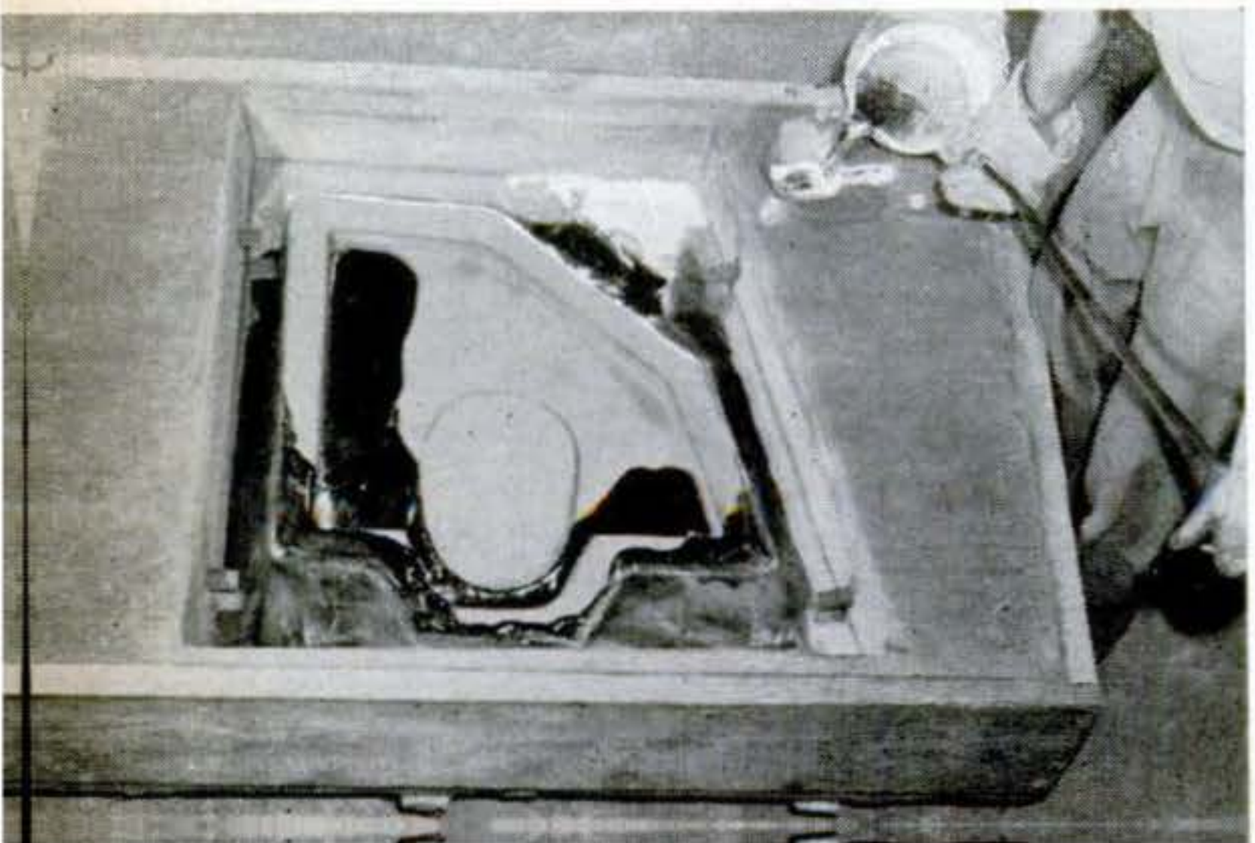
1 **Here's how** dies are made for press on previous page. Plaster cast, from mock-up of wood and plaster, makes pattern at left. Green sand packed around it forms mold.

# *Impact Stamping Uses Alloy Dies*

2 **Pattern** (top of picture) is lifted from sand, and skilled workers smooth out any rough spots. Glass-smooth mold is then ready for molten alloy to form the lower half of the die.

3 **Worker pours molten Kirksite** through gate at side of mold to make lower die. This low-melting-point alloy of zinc, aluminum, and copper is liquid at a temperature of 900° F.



4 **Antimonial lead** is poured directly over working surface of Kirksite, which has been coated with "parting compound" of carbon smoke or refractory clay, to make upper half of die.



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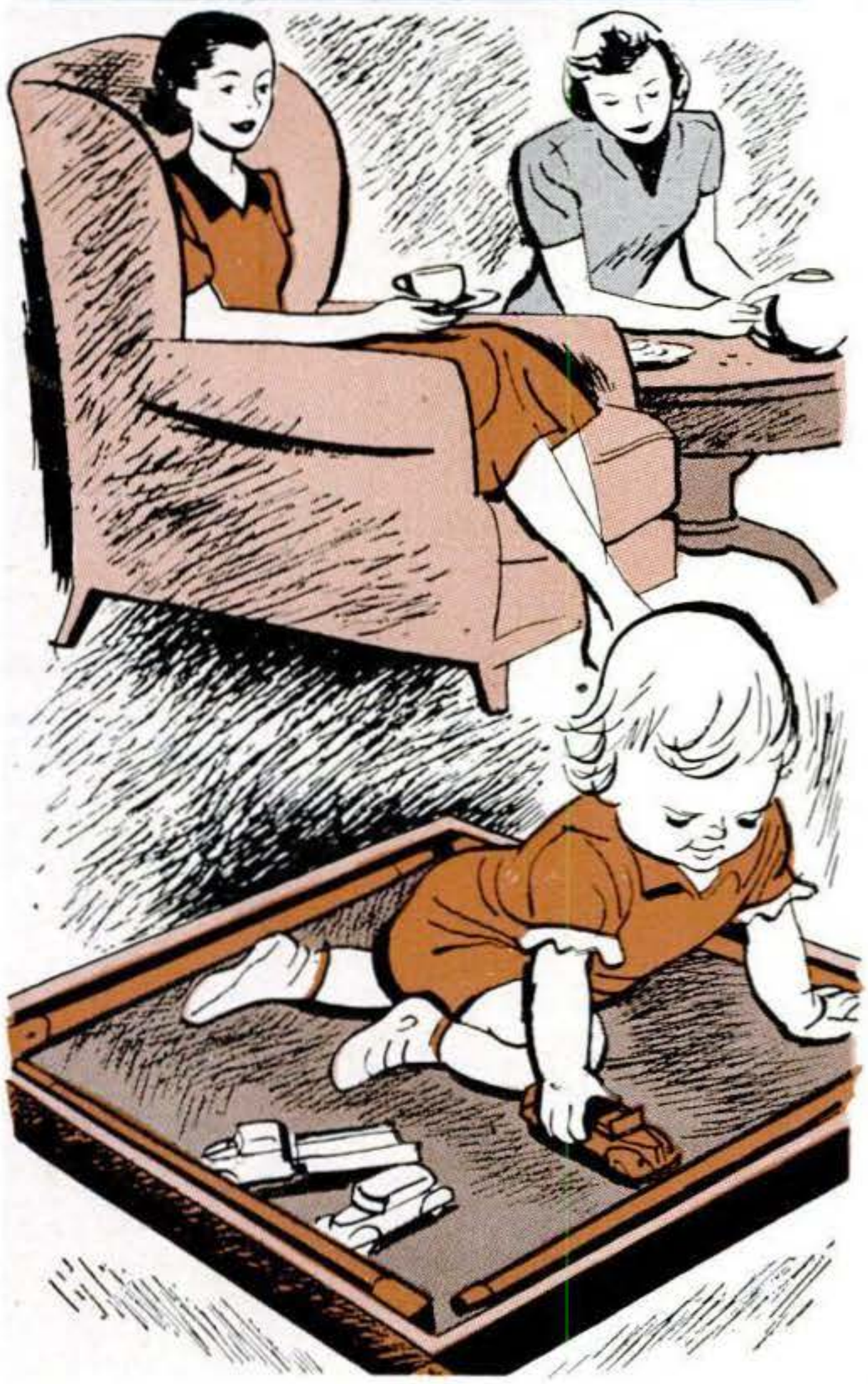
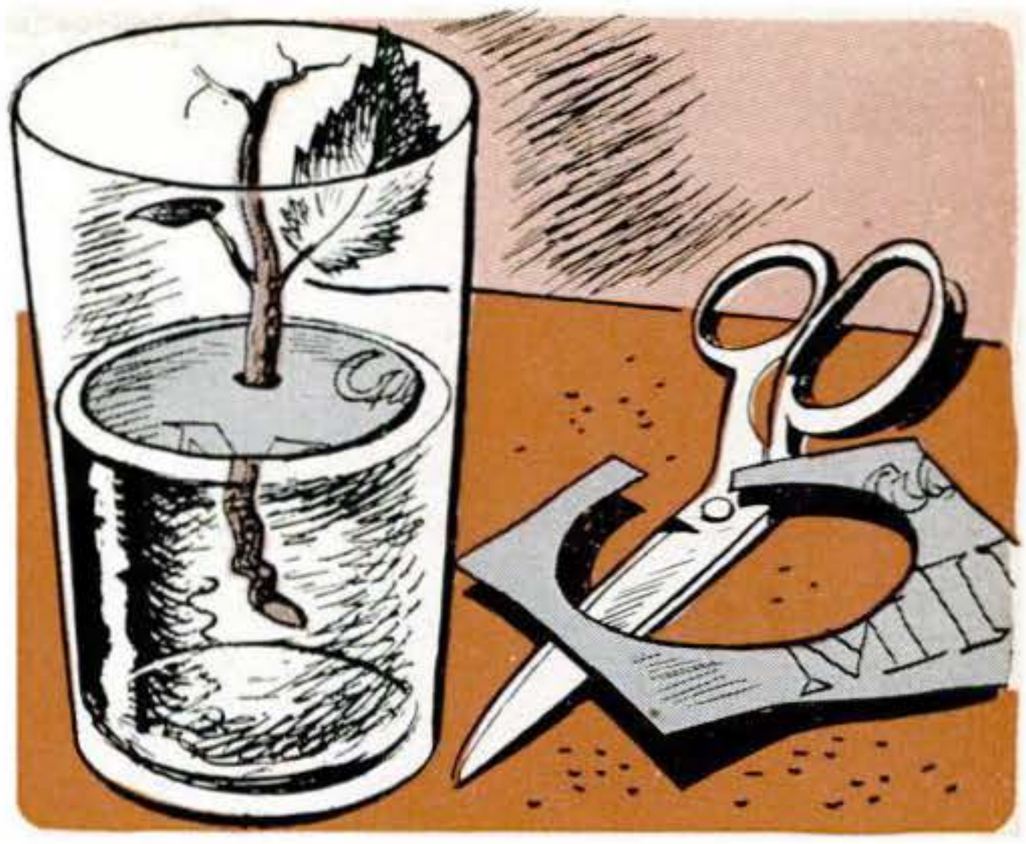
# Keeping the Home Shipshape

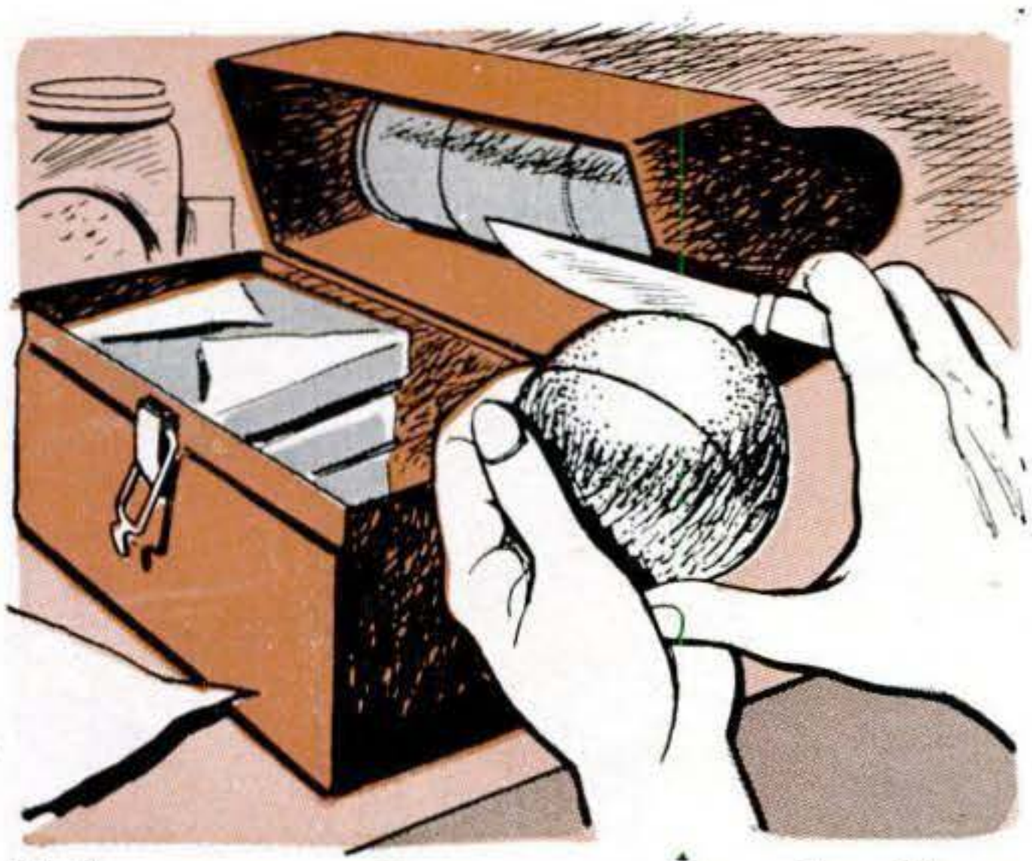


**If you want to keep Junior** from scooting his toy autos under pieces of furniture, try this: turn a cardtable upside down. He'll still have enough room to roll the toys around.

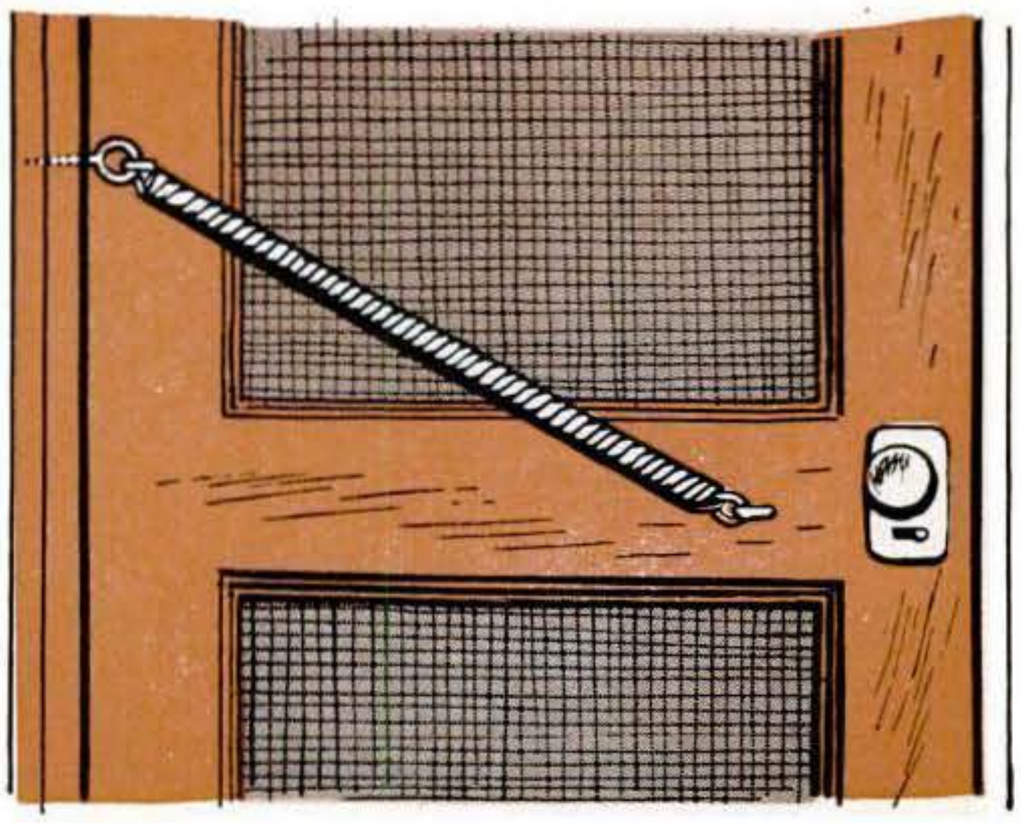


**To start a plant slip,** cut a circle from a milk carton and punch a hole in the center. Push the stem through the hole and float the cutout in water. When roots show, plant it.

**Where several persons** use one key—for storage room or garage—chain the key to a discarded metal radio tube. Snip off the prongs and use a radio socket to hang the tube.



**Before you pack an orange** in a lunchbox, cut four slits with a sharp knife through the rind to the white part. These cuts will make the orange much easier to peel.



**By placing the closing spring** on a screen door at an angle, support will be provided to help prevent the front edge of the door from sagging and dragging on the doorsill.

***Please turn the page for five more suggestions***



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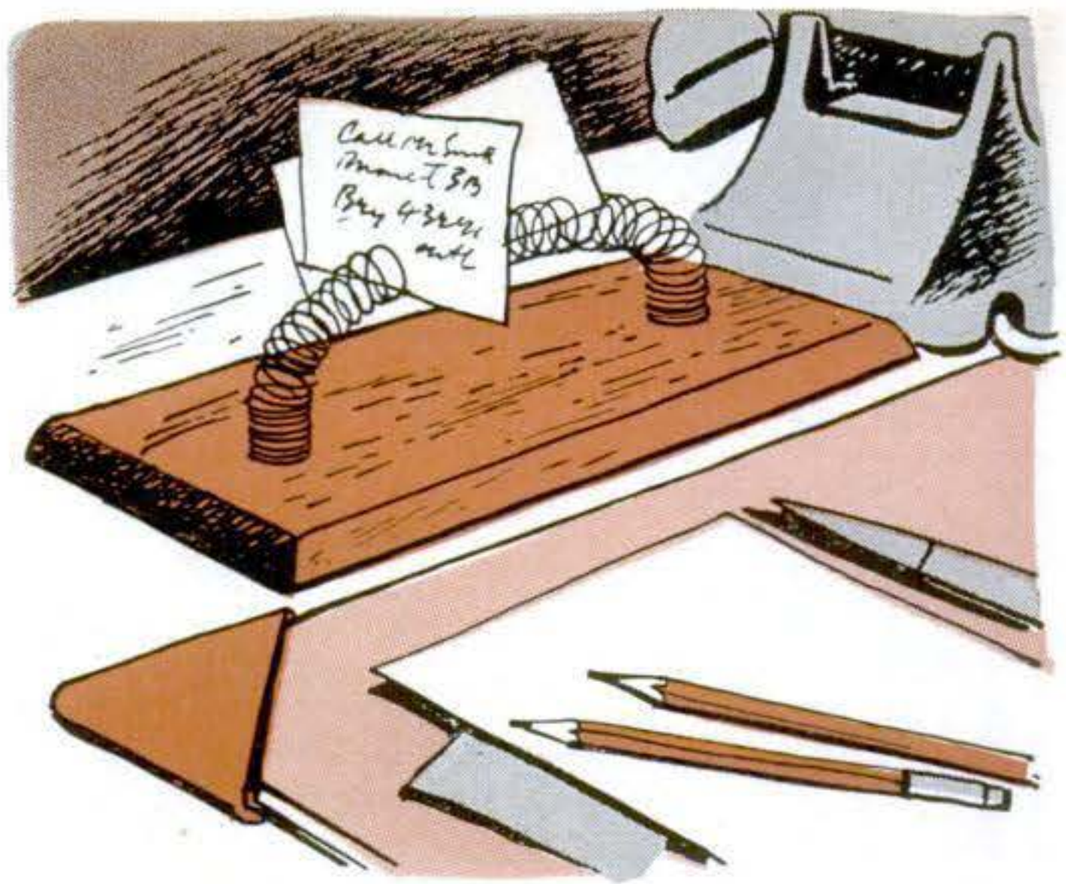
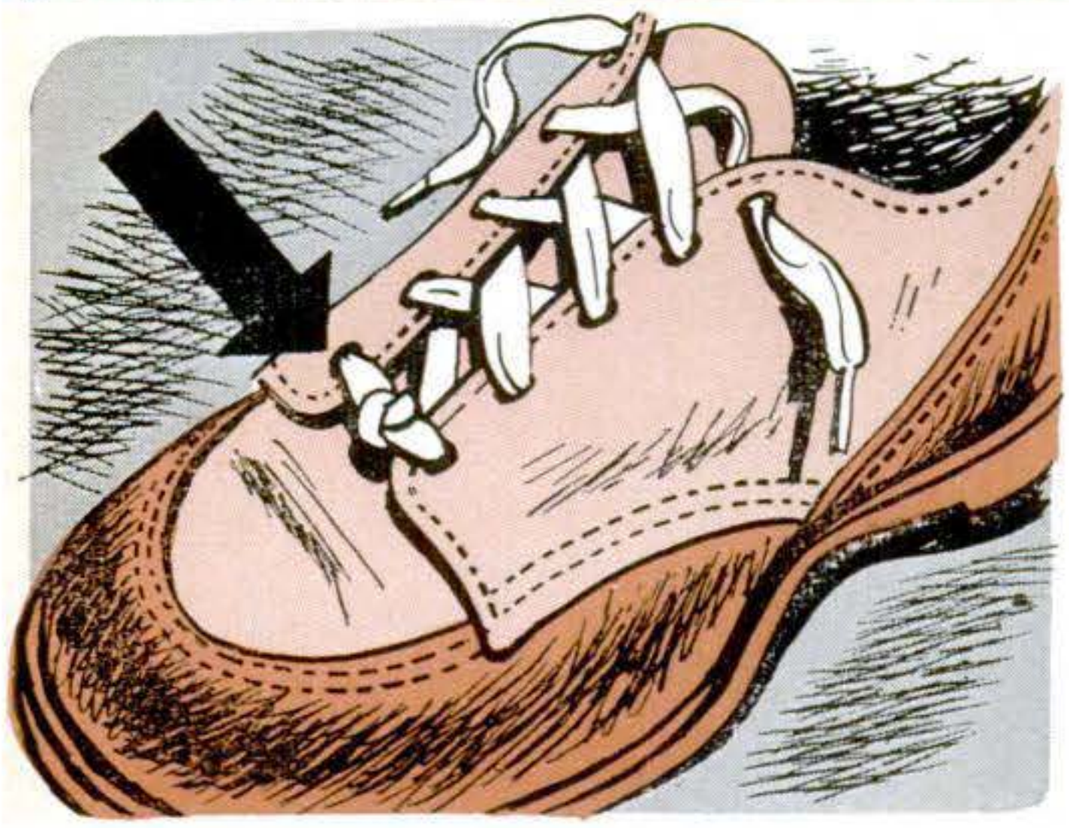
## *Keeping the Home Shipshape*

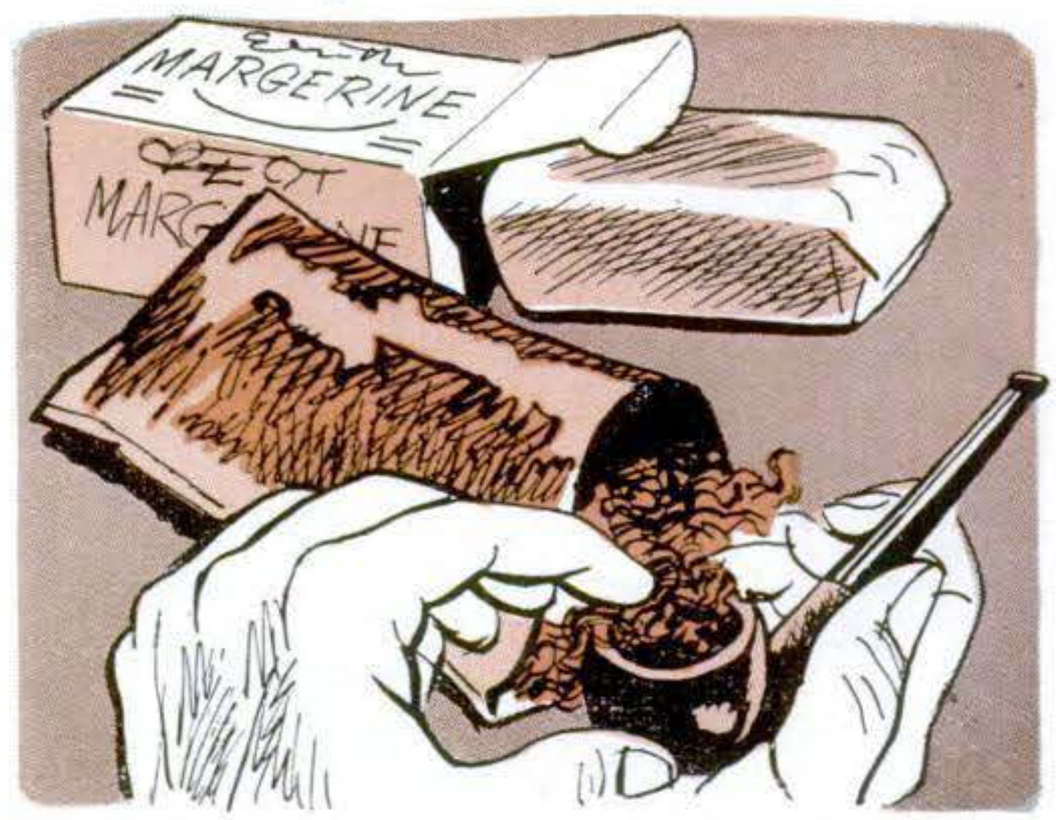
**When patching a trouser leg,** slip a rolled-up magazine inside the leg and then let the magazine unroll. It will hold the material smooth as you sew the patch in place.



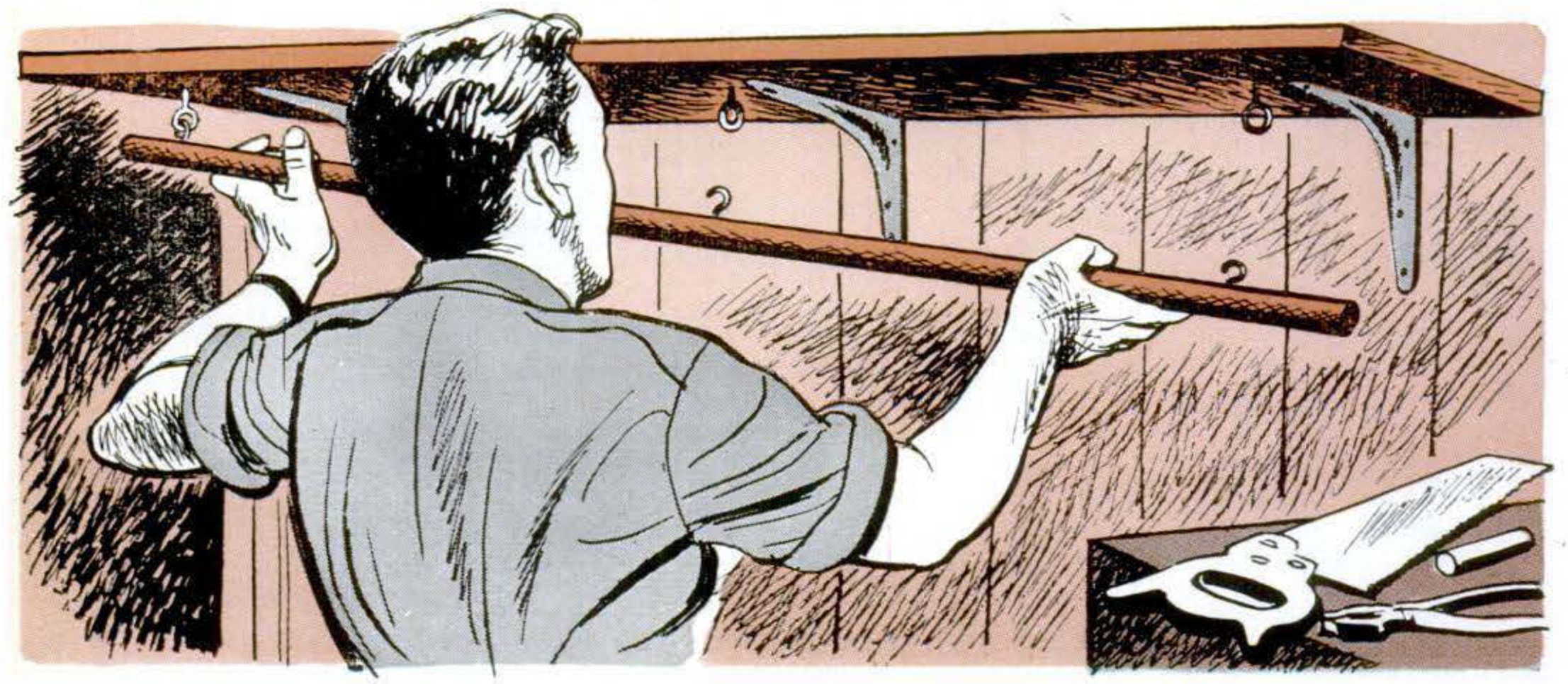
**Here's a handy message** or letter holder. Drill holes in a wooden base and glue dowels in the holes. Force the ends of a spring over the pins. The coils will hold your messages.



**If your youngsters** pull their shoelaces to uneven lengths, try this: Tie a knot in the middle of the lace before threading it into the shoe. The ends will stay the same.




**The plastic bags** used to package olemargarine make good dustproof, moisture-tight containers. When empty, turn them inside out and give them a good scrubbing with soap.



**Here's the way** to put a removable clothes hanger under a shelf. Screw three cup hooks into a broomstick and three screw eyes into the bottom of the shelf as shown in the drawing.



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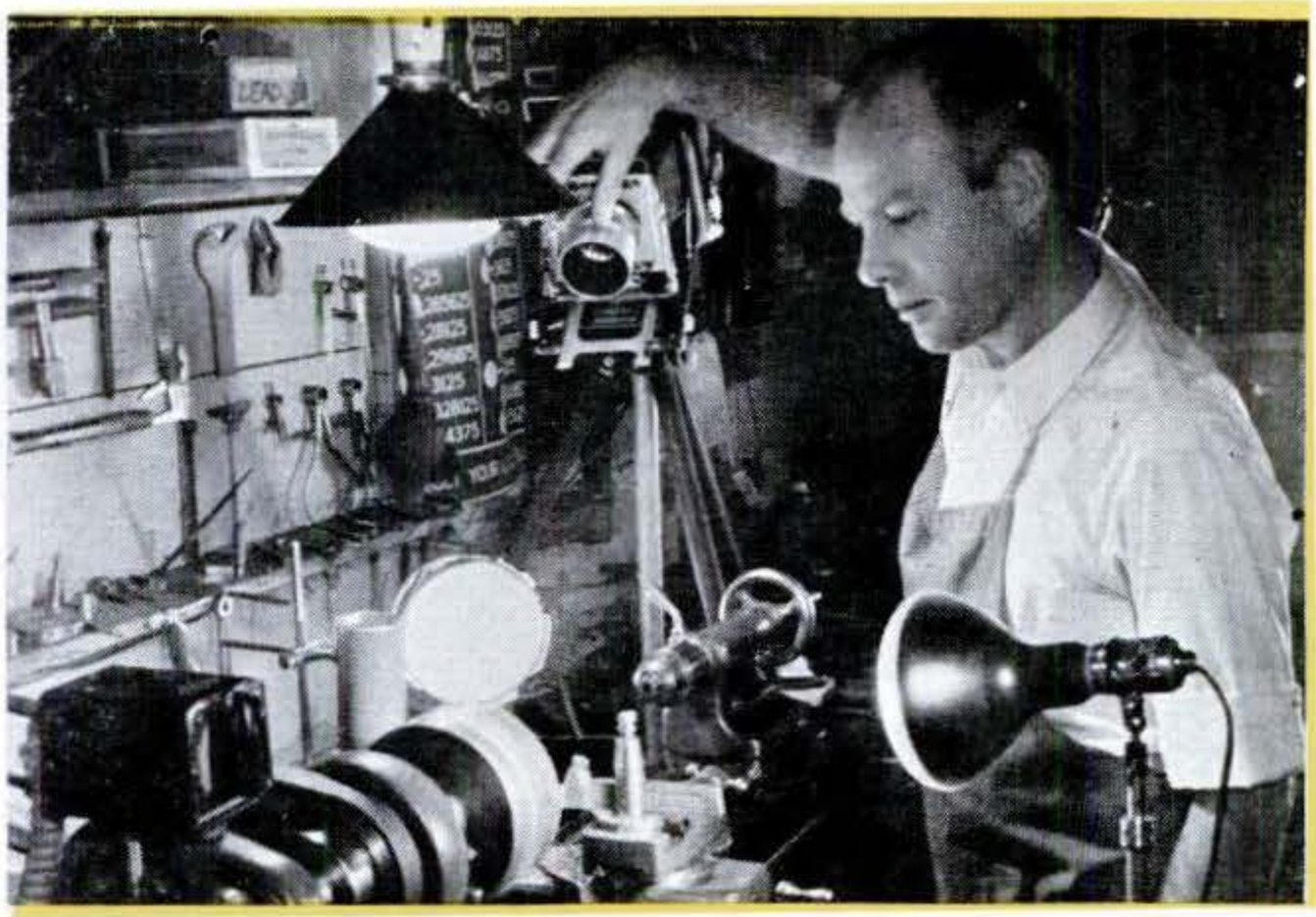
# Mechanics and Handicraft

REG. U. S. PAT. OFF.

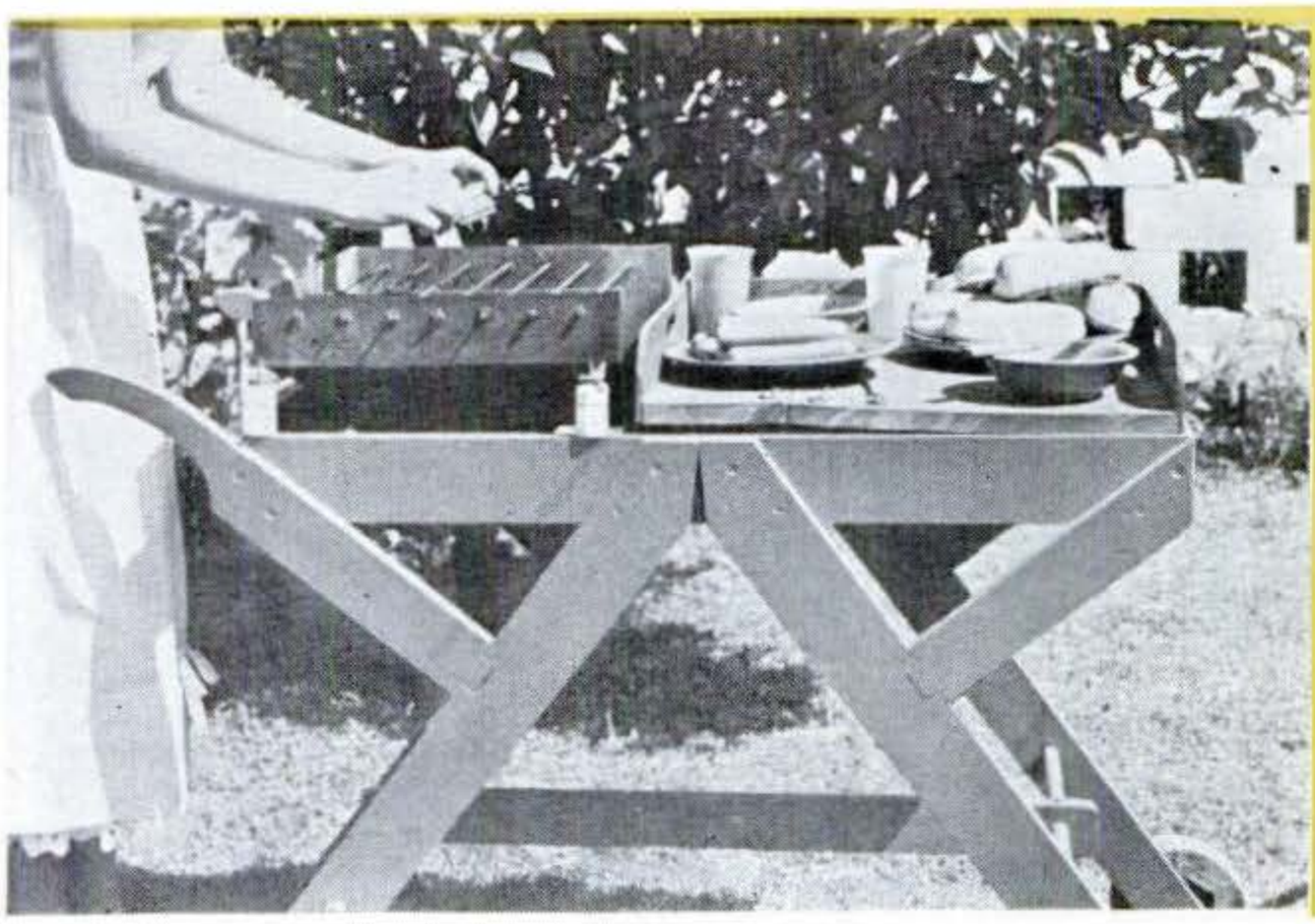
## Garage

***Built for a child, the car at left serves grown-ups. It's described on page 193—one of this month's 18 pages of auto features.***



## Shop

***Taking pictures of shop-work is fun but tricky.*** **POPULAR SCIENCE** ***shows you how (page 226) —in one of many home-workshop features.***



## Home

***Why buy lawn furniture when you can make it yourself? Eight pages (starting on page 210) feature directions anyone can follow.***



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# Gus Remembers the

*Gus stopped dead in his tracks, then wheeled the analyzer back to its corner.*

# Homeless Wasp

**By Martin Bunn**

**When a husband wants to save fenders, he's apt to put the car in the garage for his wife. Gus proves that this has its perils, too.**

ON JOE'S day off, Gus Wilson generally helps man the Model Garage's gas pumps. Although Gus always gripes jokingly that it cuts into his master-minding at the repair bench, he really likes the chance to gossip with such old customers as have nothing wrong but a thirsty tank.

It was mid-morning on one such day when a honking horn brought Gus to the shop doorway. A glistening new 1950 sedan was parked beside the first pump. Gus didn't recognize the car, but he did recognize the driver. It was Paul Tarlin, who had shucked his O.D. uniform for the quiet gray worsted of a rising young assistant cashier at the bank.

"Hi, Paul," Gus greeted him. "Where'd you get that fancy jalopy?"

"Gus, you're the first man in town to gaze on the Tarlin's first brand-new car," Paul boasted proudly as he slid out of the driver's seat. "Just picked it up at the dealer's—a beauty, what?"

### *New Filly a Dilly*

As the two men walked around the shiny gray sedan, they looked for all the world like a couple of horse fanciers judging a prize mare. The illusion was completed when Paul lovingly patted the car's gleaming flank.

"So you finally broke down and parted with that paintless '39 convertible," Gus said as he reached for the gas nozzle.

"Had to," replied Paul, "if only to keep peace in the family. Agatha got so she practically wouldn't ride in the old bus. And when she drove it herself, something always happened. Besides," he added with a smile, "Agatha's mother is coming over from England for a visit, and I'm afraid the old heap wouldn't have given her a good impression of modern industrial America."

As Paul talked, Gus noted that the dealer in the city certainly had done a Grade A job of selling Paul the works. The car had everything: fog lights, backing lights, heater, radio, exhaust-pipe deflector, seat covers, bumper guards. Gus figured it probably had cost Paul at least $200 more than the naked price.

"She rides and drives like a dream, Gus," Paul continued enthusiastically. "Lots of power, and I never realized before how smooth bumpy roads can be. There's just one thing that's worrying me. Is she or isn't she going to fit in that old-size garage we've got? I measured the other day, and I figure I should just about be able to squeeze her in."

"Well, you can always leave the doors open," Gus said. "How much gas, Paul? Shall I christen her with a full tank?"

Paul nodded. "And while you're at it, Gus, I wish you'd check the oil, water, and the battery, just in case those guys down in the city slipped up on something."

When Gus had completed his rounds and slapped down the hood, Paul climbed back into the driver's seat. "Well, off to Agatha," he said as he pressed the starter. "You know, this is all a surprise for her. She hasn't the foggiest! When I left this morning in the old car her parting shot was, 'Well, I hope you'll at least have that car washed and polished before Mother arrives.' "

### *Petrol in the Tank*

As Paul swung his new pride and joy onto the road, Gus watched him go. Perhaps the fact that Paul also was an ardent fisherman had something to do with it, but Gus liked him. He liked Agatha, too, in spite of her unfamiliar way of speaking. Paul had brought back a wife, complete with accent, from Britain. They had settled in a remodeled farm cottage about eight miles from town and since had become a popular couple. Paul was doing a fine job at the town bank, and Agatha had adjusted herself to American ways, even if she



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did slip up now and then with "petrol" or "spanner" or "wind-screen."

Gus didn't see Paul, Agatha, or the new car again until the following Friday. Then it was a worried-looking Paul, a bristling Agatha, and an ailing automobile. It was about 8:30 in the morning when the Tarlin's new sedan sputtered to a stop in front of the Model Garage.

### *Talk About Trouble*

As Gus approached, both Tarlins started talking at once, with Agatha getting the best of it. All Gus could filter out of the babble was that something was wrong with their car—he'd already guessed that—and that this was the day they were to meet Agatha's mother in the city.

"Whoa," shouted Gus. "Let's take one thing at a time."

"But that's just it, Mr. Wilson," cut in Agatha, "we haven't got the time. Mother is due on the noon train and it takes fully an hour to get to the city. You've simply got to do something about it in a hurry, Mr. Wilson, really."

Gus long ago had got used to people demanding repair miracles in a matter of minutes, so he paid only smiling attention to Agatha's last comment. Instead he turned to Paul. "Well, what's the trouble, Paul?" he asked.

"It's all rather odd, Gus. We got into the car this morning so Agatha could drive me over to the bank so I could do a little work before we left for the city. First off, Agatha had trouble getting the engine started. Then, when we'd driven about a quarter of a mile toward town, the engine began to miss badly and Agatha complained that it had no power. To make sure, I slid over into the driver's seat."

### *Agatha Gets the Brush*

At this point Gus, who had been watching Agatha's strained efforts to keep from butting in, made a suggestion. "Mrs. Tarlin," he said, "you've probably got all sorts of last-minute chores to do at home to get ready for your mother's visit. How about your driving on home in my car?"

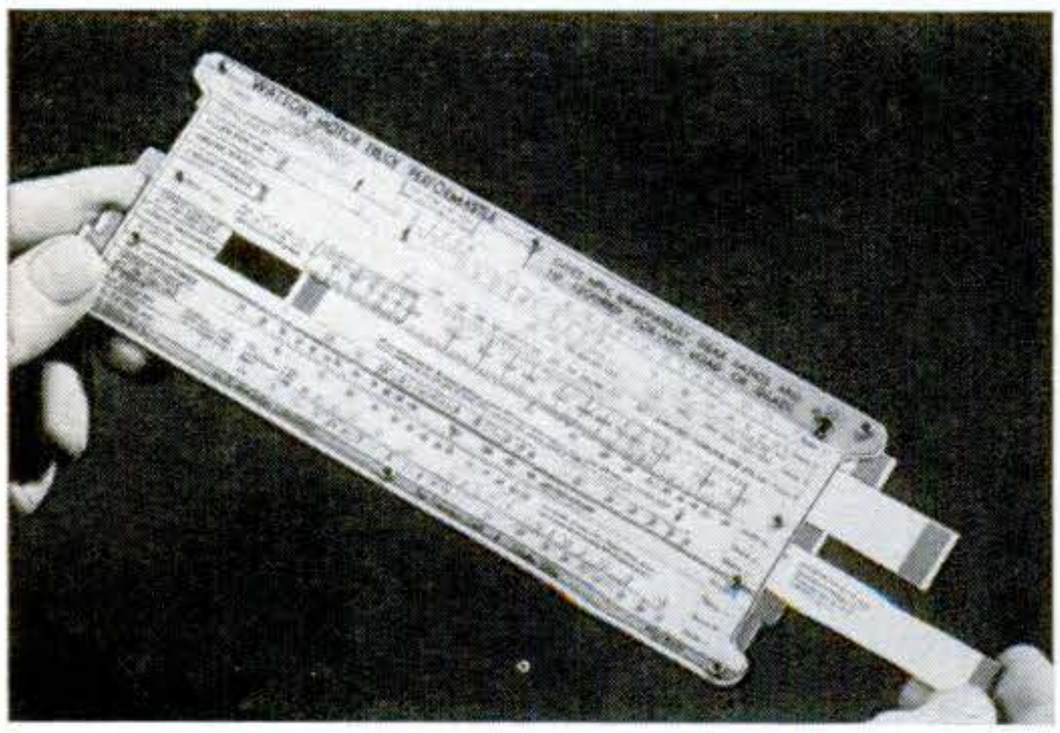
As he spoke, Gus literally pushed Agatha toward where his car was parked. Agatha had no time to protest.

"Now, then, Paul," Gus said, "let's you and me take your Gray Beauty for a short spin while you tell me the rest of it."

### *She Runs a Temperature*

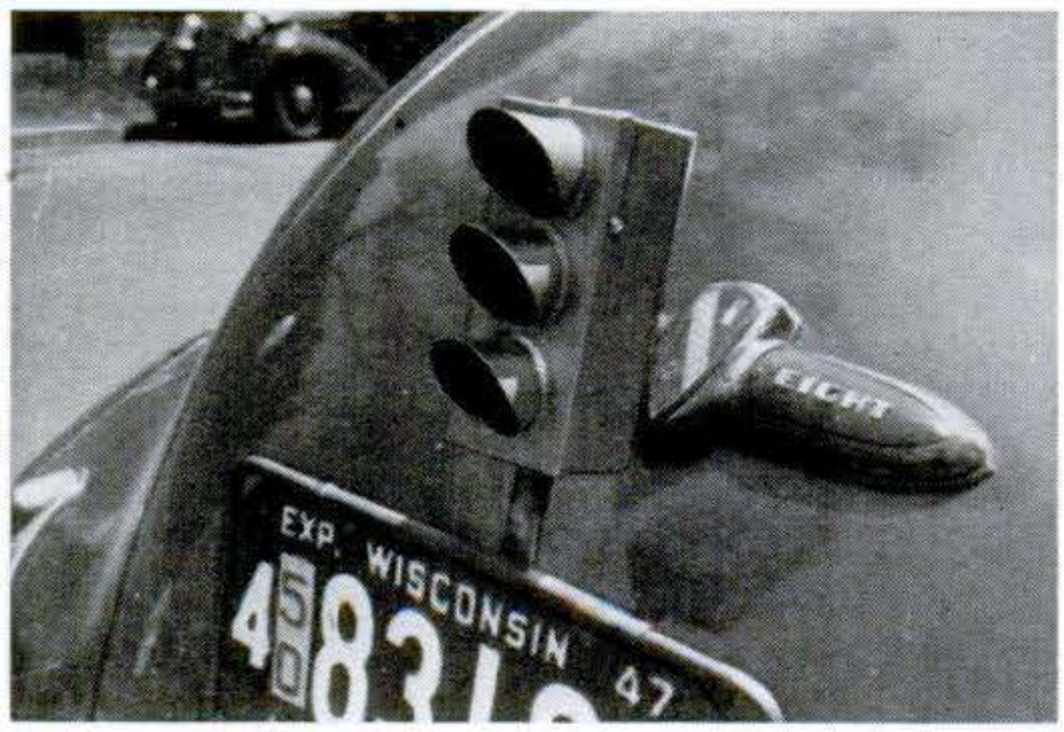
Gus, too, had difficulty getting the engine started, but eventually it ticked off and he swung the new sedan onto the highway. As he stepped on the accelerator, however, the engine spat and coughed.

## Slide Rule for Truckers



IF YOU want to know in advance what gear ratio and horsepower will be required for a truck at any speed on any grade and under any load, you can figure it out on this new slide rule. It digests such items as engine revolutions, torque, transmission and axle ratios, tire size, gross weight, and type of road and grade, and comes up with the answer. Made of Vinylite, it's distributed by H. S. Watson Co., San Francisco, at $2.50.

## Stoplight Tells Speed




A THREE-COLOR Stop-N-Go Lite® for the rear of an automobile automatically tells the driver behind whether a car is traveling more than 10 miles an hour. A green light goes on when the car exceeds that speed. An amber light glows when brakes are applied, and a red one indicates speed is 10 m.p.h. or less. Made by Harrell Products, Milwaukee, the device has only two connecting wires and is easily installed.



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"Well," Paul continued, "it was just like this. The engine missed and wouldn't take the gas and had no power. Then I happened to glance down at the temperature gauge. It was almost up to 200."

"Did you check the radiator?" Gus queried.

"That's the very next thing I did. But the water level was up and the water seemed to be circulating."

### *Coaxing Is Needed*

By this time they were back at the Model Garage. Gus drove, or rather coaxed, the car into the shop. Leaving the engine running, he got out, opened the hood, and unscrewed the radiator cap. Evidently satisfied with what he saw, he shut off the ignition and checked the wires leading to the spark plugs.

"Could be the timing," he muttered as he walked toward the far corner of the shop and started to wheel his ignition analyzer toward the car from the rear. About halfway to the car he stopped dead in his tracks, stood there motionless for a moment, and then wheeled the analyzer back.

"Let's get this car up on the greasing rack," Gus said. As the car reached its top position Gus walked under and began probing around the right side of the rear axle with his extension light.

"How do you park this car in your garage, Paul?" he called out, without taking his eyes off the underside of the car.

"What do you mean, how do I park the car in my garage?"

"I mean do you drive it in head first, or do you back it in?"

### *Agatha's Reverse English*

"Oh, I back it in," Paul replied. "Backing a car in tight spots isn't one of Agatha's best accomplishments. So to make it easier for her, I always do it. Then there's less chance of her picking up wrinkled fenders. All she has to do is drive straight out and she's in the clear. But what's that got to do with it?"

Gus had a wry smile on his face as he ducked from under the greasing rack. "Paul, about all that's ailing your car is a tight garage."

"A tight garage?" Paul repeated.

"Yup. Plus one of the fancy gimmicks the dealer sold you. I'll bet you a dry fly against a bare hook that when you put the car away at night you have to back it in until the rear bumper hits the rear wall of the garage. Right?"

"Right," Paul agreed. "I have to get the car all the way back. Otherwise, I can't close the garage doors."

### *Lip Is the Villain*

"And right there is your trouble," said Gus, pointing to the end of the exhaust pipe. "See how the lip of that pretty chrome exhaust deflector is bent down? Originally, it extended beyond your bumper. Well, each time you've backed into your garage you've bent it a little more when you hit the back wall. That helped to close off the end of your tailpipe.

"But that's not all. Each time you bumped the rear wall, the force of the bump was transmitted through the deflector and along your exhaust pipe until the pipe began to buckle at its weakest point—the point where it loops up to clear your rear axle. Evidently, the bump you gave it last night was just hard enough to finish the job and start the trouble. Come here, I'll show you."

Gus led Paul under the car and pointed up at the exhaust pipe.

### *With an Assist from a Kink*

"Why, that pipe's practically kinked closed," Paul exclaimed.

"That's right," said Gus. "And because it's almost kinked closed, it's been acting as a stopper to build up enough back pressure to cut down your engine's power, making it miss and buck when you gave it the gas."

"I guess I'm a little dumb on the mechanical side," put in Paul, "but why?"

"Ever try to blow your nose when you're pinching it closed? Ever try to push down on the handle of a tire pump when you're holding a finger over the end of the connecting tube?" Gus asked. Then, without waiting for an answer, he went on. "Well, it's the same way with an engine that tries to compete with some obstruction in the exhaust line that keeps the engine gases



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from escaping. The back pressure builds up a cushion against the motion of the pistons. What's more, the proper air and gasoline mixture isn't drawn into the cylinders. The two combine to make the engine miss and lose power."

"But what caused the overheating?"

"The same thing—back pressure," Gus continued. "Since the hot gases weren't being exhausted as fast as they should be, they produced more engine heat than the cooling system was designed to carry away."

"Well, what do I do now?" Paul asked, consulting his watch.

"The first thing we do," Gus replied, "is take the kink out of that tailpipe so you can pick up Agatha and meet your English mother-in-law. When you have time, better get the dealer to install a new one. If you still want one of those fancy gadgets on the end of your exhaust pipe, fasten a four-by-four to the floor of that tight-fitting garage of yours to act as a block for the hind wheels. That'll stop you from smacking the deflector against the wall when you back in. Or, you could teach Agatha to back out."

### *Off to Meet Mater*

It didn't take Gus long to open out the tailpipe again, so it wasn't much past 9:45 when Paul pulled out of the shop and headed for home. He and Agatha still had plenty of time to meet the 12 o'clock train.

"What was the tip-off, Gus?" Stan asked.

"I'll tell you a secret, Stan," Gus confessed. "That car had me more than a little worried until I just happened to spot that bent-over deflector."

### *Case of the Homeless Wasp*

"Cases like that aren't too common," Gus added as he began to thumb tobacco into his pipe. "Happens once in a while when a rear-end bump bends an exhaust, or when a country driver backs into a dirt bank alongside a road and plugs his exhaust with a slug of clay. About the strangest case of back pressure I've ever run into was old Jim Hadden's car. He'd put it up for a year during the war, and when he finally took it off the blocks it had all the symptoms of Paul's car, only worse. I stopped by his place one day and he asked me to look at it. It was parked in the barn. That time it was a wasp that led me to the trouble."

"A wasp?" Stan repeated.

"That's right. I saw a wasp buzzing around the end of the exhaust pipe. When we poked in the tailpipe, there, just a few inches from the end, was a wasp's nest that all but closed up the opening. While Jim had had the car up on blocks, a family of mud wasps had built their nest inside the pipe. The little critter I saw evidently was out visiting when Jim tried to start the car and was going back home." END

## 1950 Lincolns Have New Soundproofed Interiors

TO ELIMINATE "drumming" and reduce engine noise to a minimum, the 1950 Lincoln has Fiberglass® soundproofing insulation in the roof and behind the dash. Like other models in the Lincoln and Lincoln Cosmopolitan lines, the 6-passenger coupe, shown here, incorporates more than 150 changes. These include a new instrument panel with recessed dials to prevent windshield glare, and larger heater blowers.



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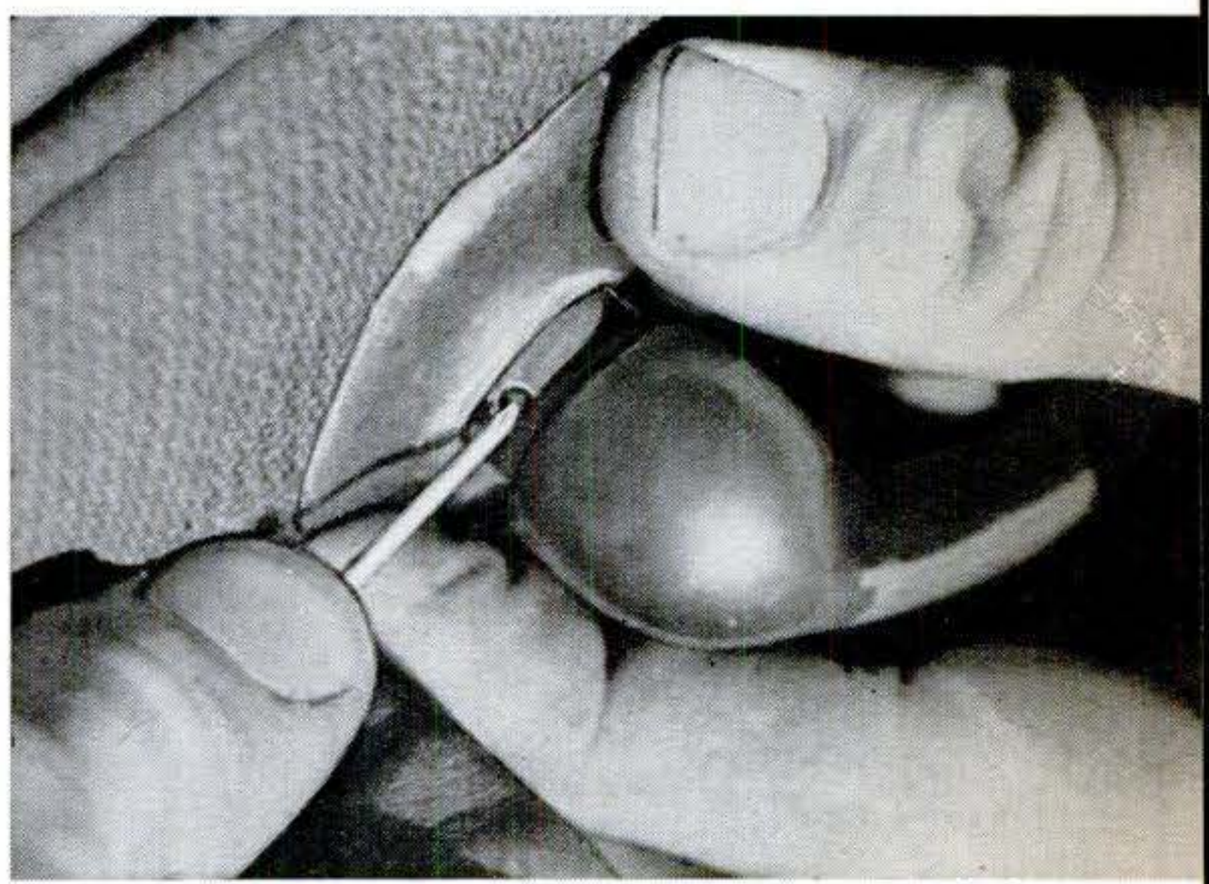
# Replace That Worn Upholstery

RIPPED or worn door lining makes a car look years older. Replacing the old lining with composition board is a simple job. You don't have to be an expert upholsterer, and all you need are a few hand tools. The board will give your car's interior a clean, neat look and it'll wear for years.

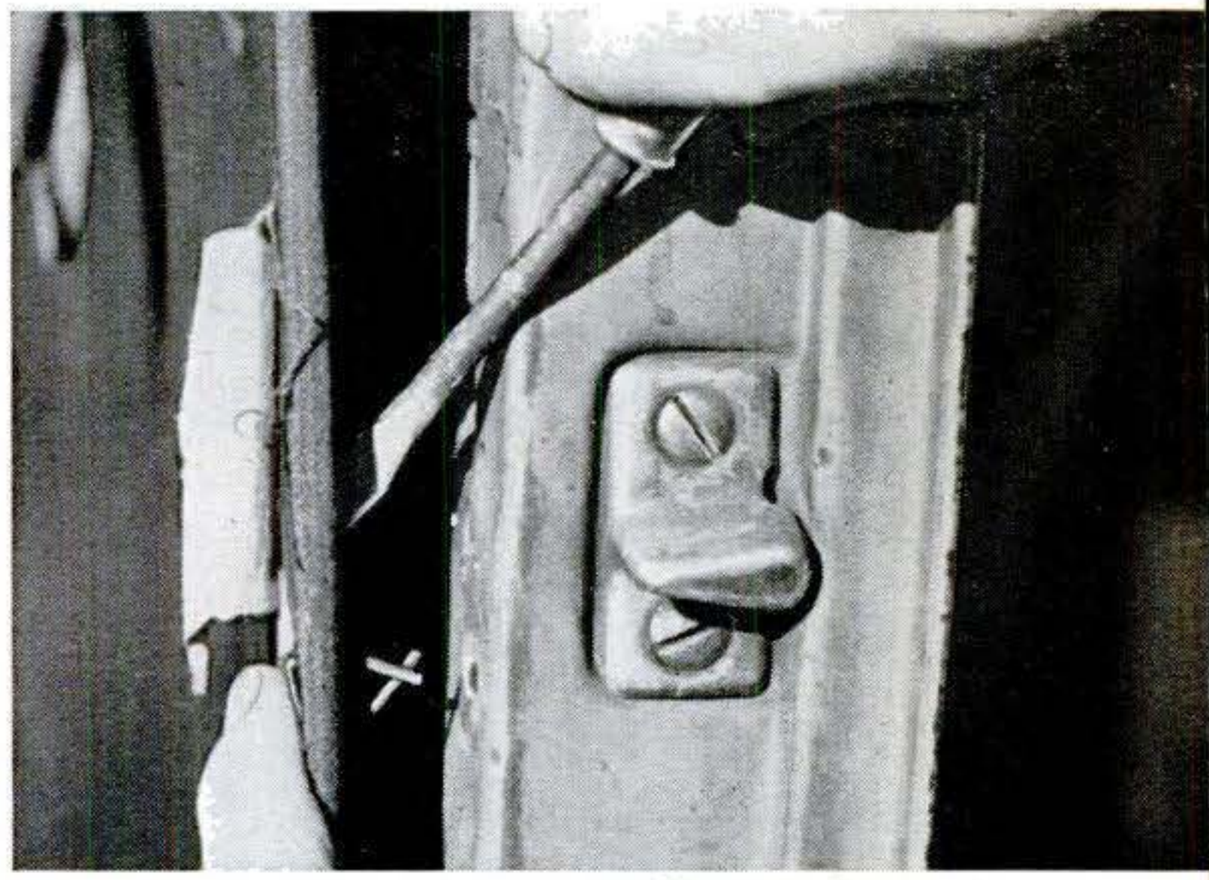
The photos below and on the next page show such a job being done with ⅛" Leatherwood®, made by the Masonite Corp., Chicago. This board has a simulated-leather surface. The board requires no finish, but you can paint or tone it to any shade you want. It can be cut with an ordinary saw, but should be cut slightly full. Frayed edges left by the saw can be removed by careful filing after the new panels are mounted on the car doors. Use a medium file and draw it from the surface of the board toward the back. Don't file in both directions or you may chip the board.

After you've cut out the new panels, clamp them in place on the doors. Check the location of the holes that are already ➧

**First step in replacing** upholstery of car door is removing window frame. Back out screws and you can lift the frame out of the window.



**Take off door handle** and window crank. Press inward on base plate to expose lock pin. Use small nail to push pin out of collar and shaft.



**The old backing board** usually is held to door by spring prongs snapped into holes in door. Pry prongs out of door with a screwdriver.



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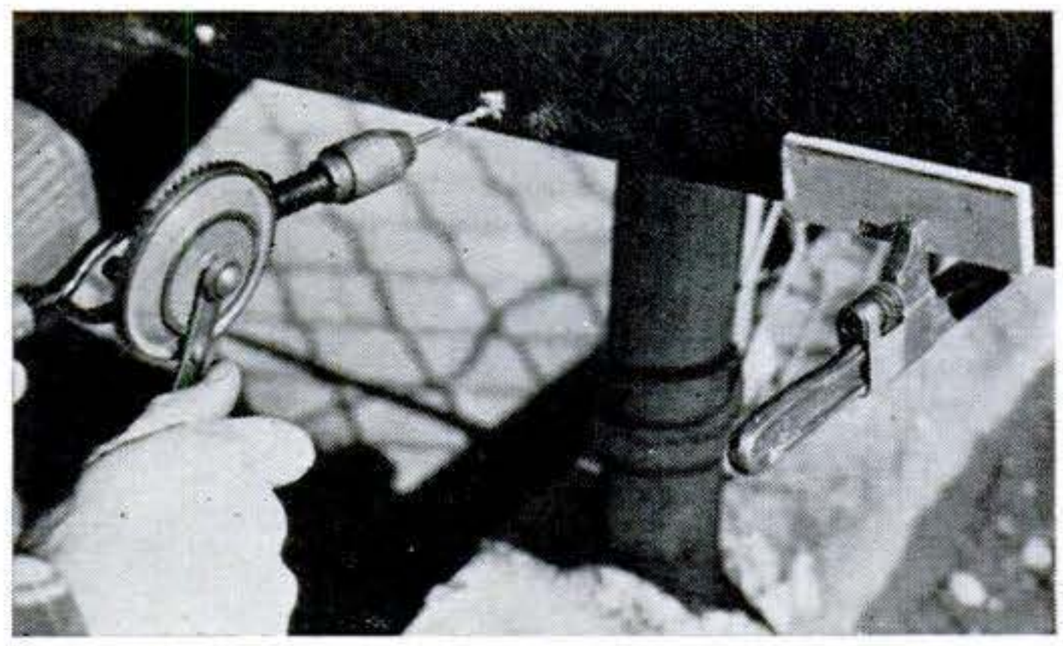
in the door before you drill new holes. Then you won't be drilling through the board and into an old hole. The old holes will be too large for the ½" 8-32 self-tapping screws that you'll use.—*Emil E. Brodbeck, Mt. Vernon, N. Y.*

**Place new material** face down. Put old board face down on top of it. Use old board as pattern and draw all around it with chalk.

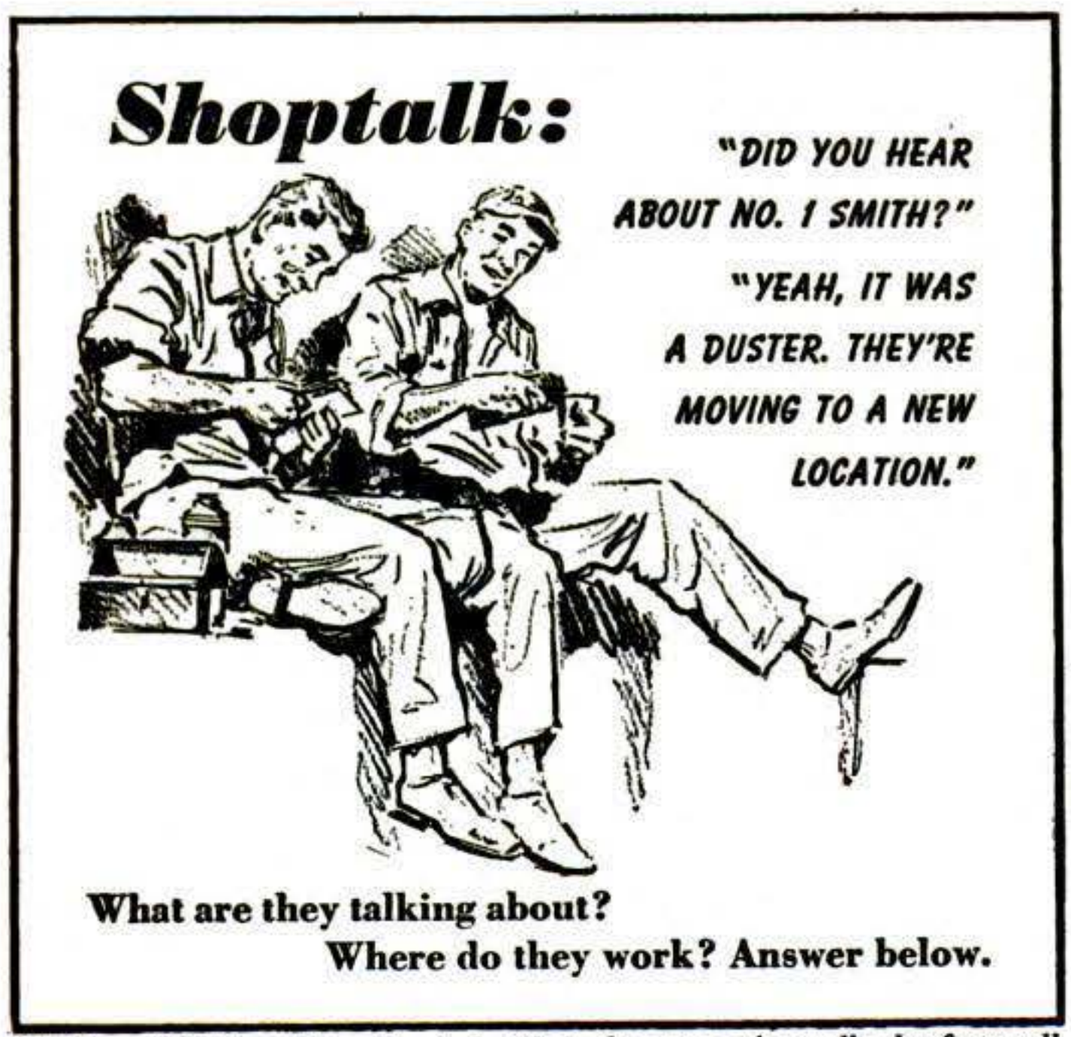


**Use No. 28 drill** and ½" 8-32 self-tapping screws. Drill holes through composition board and into car door. Space holes 6" or less apart.

**Holes for window crank** and door handle will have to be drilled before board is mounted. Round edges of the board with a file.

## Paper Cup Lines Gluepot

When mixing a small quantity of glue or wood filler, I raid the kitchen for one of the paper containers that's used for baking cup cakes. I insert this in a small tin can, mix the glue in the cup, and, when I'm through, discard the cup. Result: no messy gluepot to wash out.—*Tom Griberg, Moline, Ill.*




*They're oil-field workers. No. 1 Smith is the name of a well—the first well drilled on the Smith lease. Duster is a dry hole. The drill rig is being moved to another spot to drill another well.*

## He Drives from the Sidecar

When August Paul travels with his motorcycle, he rides comfortably in the sidecar instead of straddling the bike in conventional fashion. A mechanic in Munich, Germany, Paul rigged up the vehicle himself, installing a steering wheel, gear shift, and other controls in the sidecar.



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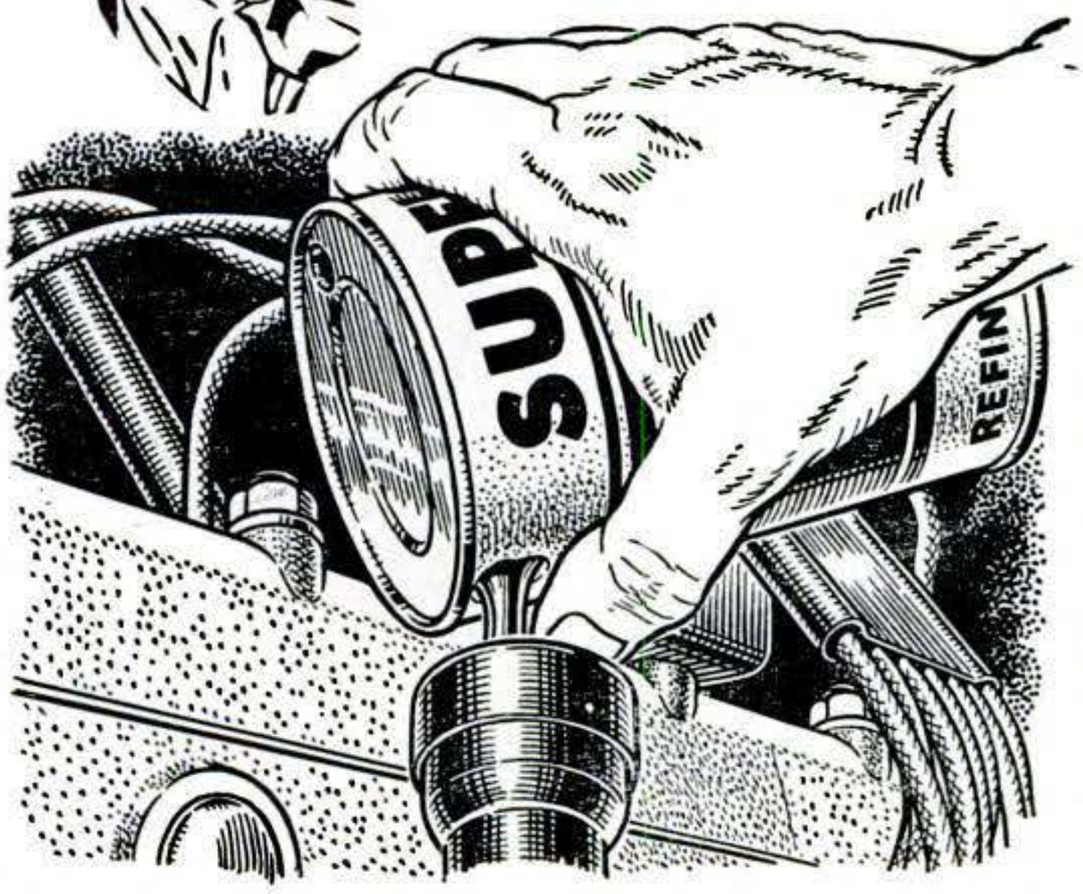
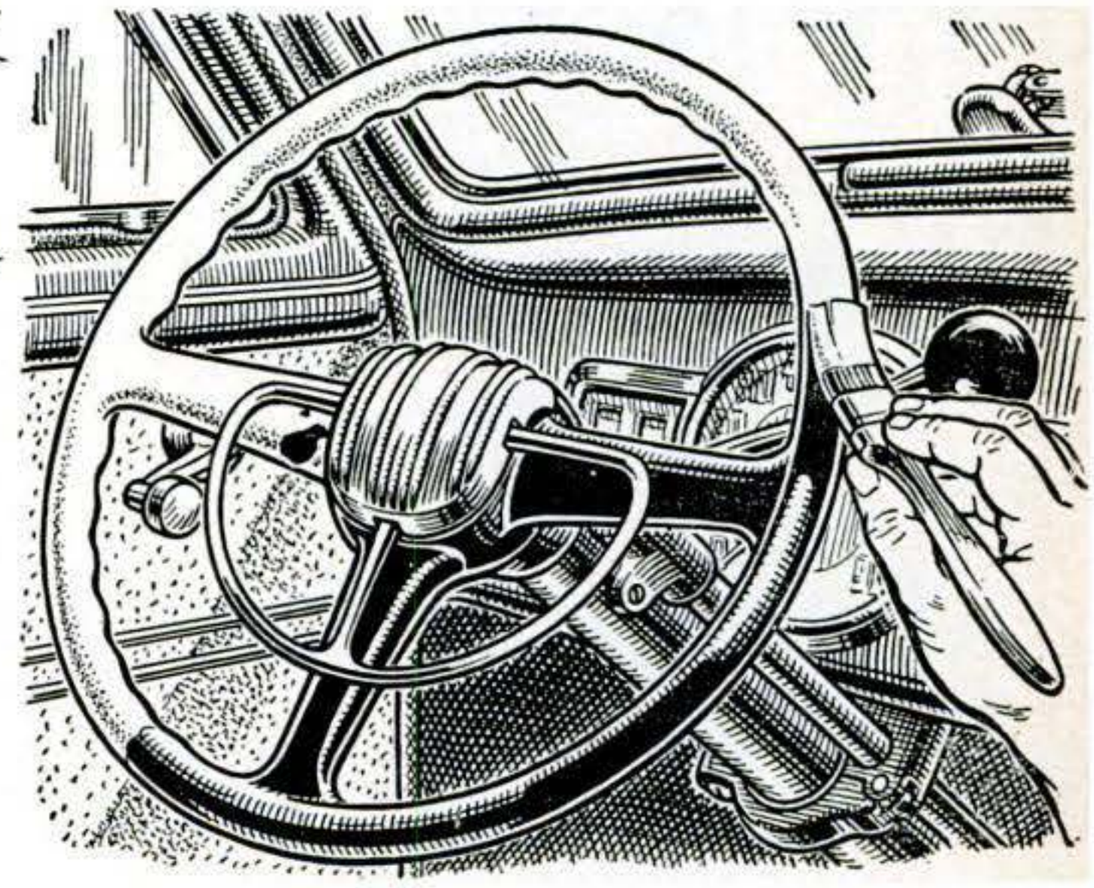
# Hints from the Model Garage

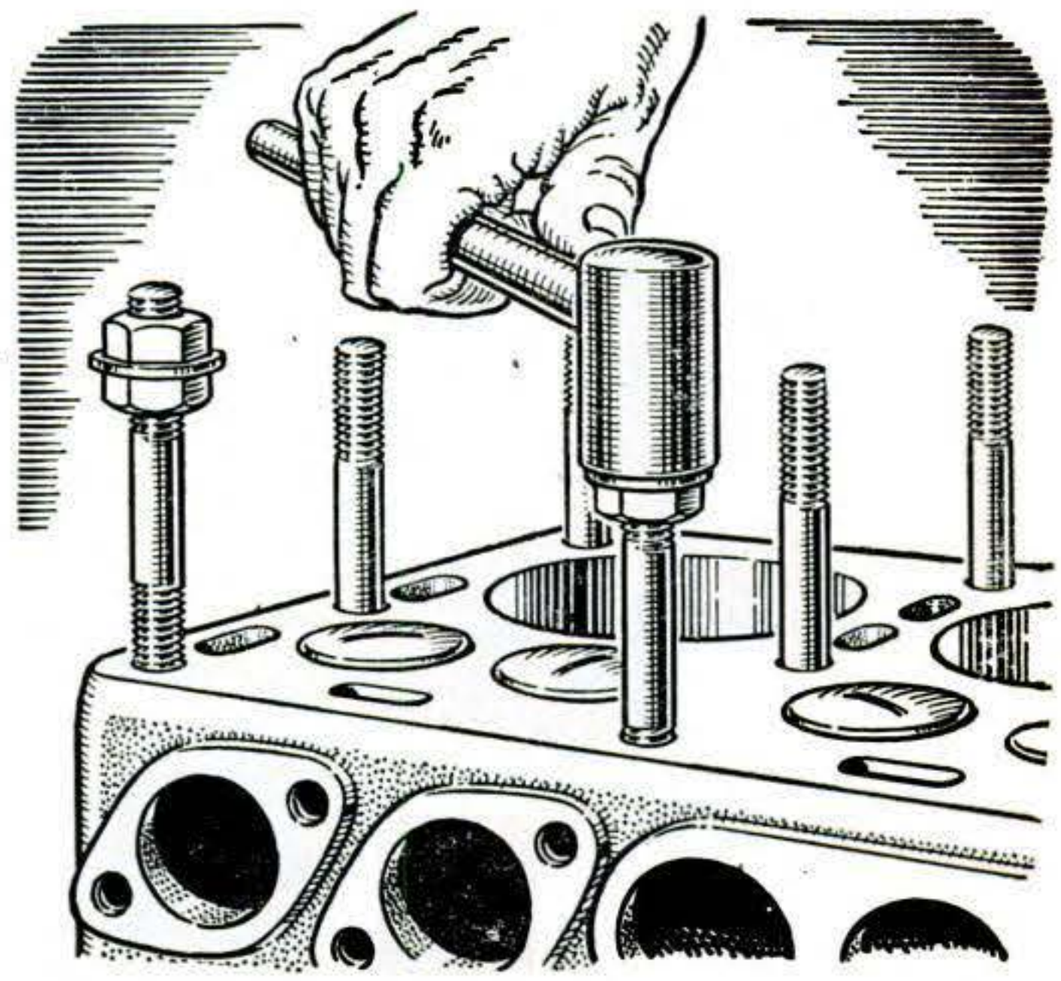



**Where's the Funnel?** If you can't find it, pour oil in the crankcase this way. Punch one hole in the top of the can and another in the side just under the top rim. Keep a finger over the side hole until it's in position over the inlet.



**Refinishing Steering Wheel.** Model-airplane dope is better than most paints for refinishing a steering wheel that tends to blacken your hands. It dries hard in a few minutes and is not affected by perspiration as paint may be.

**High-Beam Indicator for Old Cars.** If your car is an older model not fitted with a high-beam headlight indicator, you can quickly remedy the situation. R. L. Parmenter, of Middleboro, Mass., did the job as shown. Ground one of the lamp terminals. Drill a 1/16" hole through the dash ahead of the lamp and fill it with red nail polish. A fiber shield fitted around the lamp keeps light from showing on the floor.



**Two Nuts Tighten Stud.** This variation of the old two-nut trick makes it possible to use a socket wrench in reseating studs in an engine block. The washer between the two nuts keeps the wrench from slipping down over the lower one. After the stud has been seated by turning the top nut, the nuts are released by first turning down the lower one with an open-end wrench. This keeps the stud from loosening.

*Turn the page, please, for four more hints*



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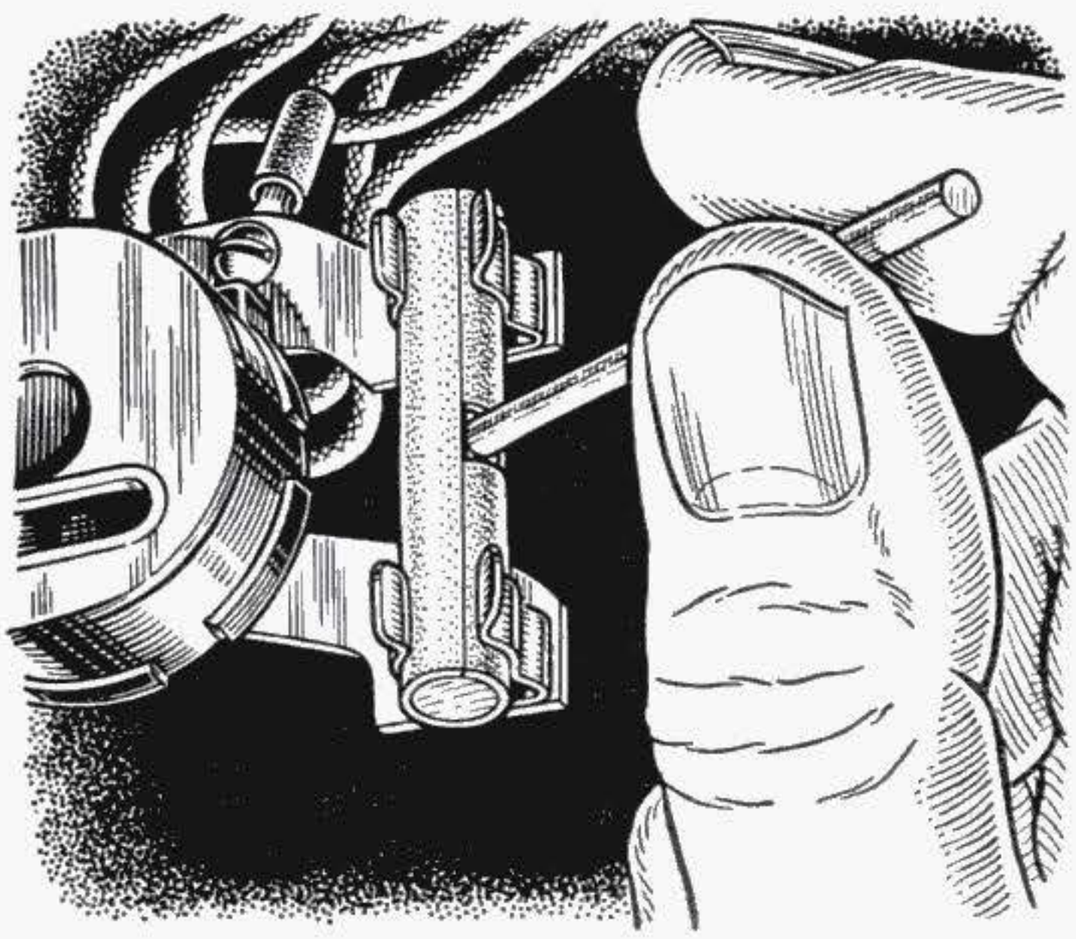
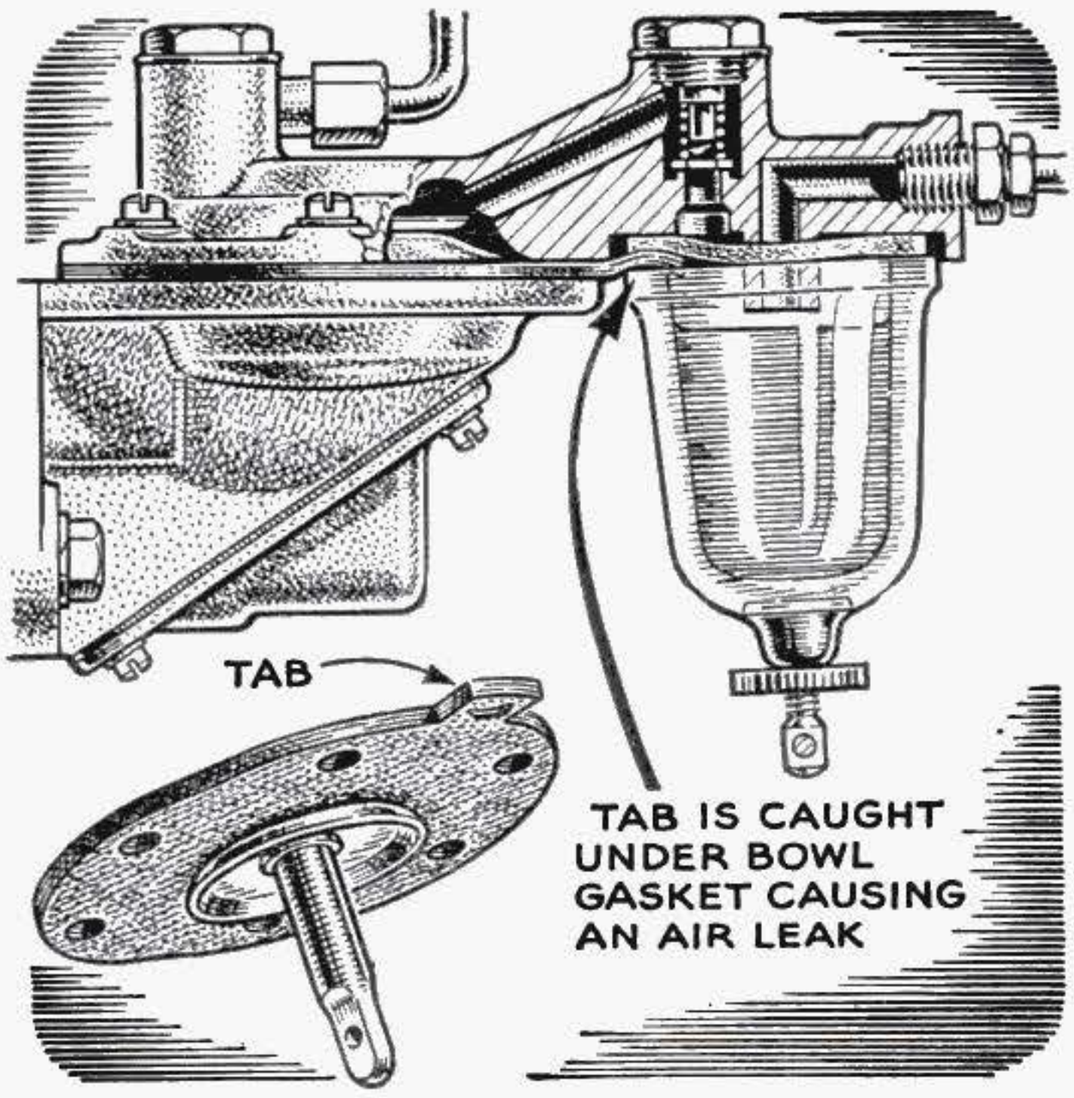
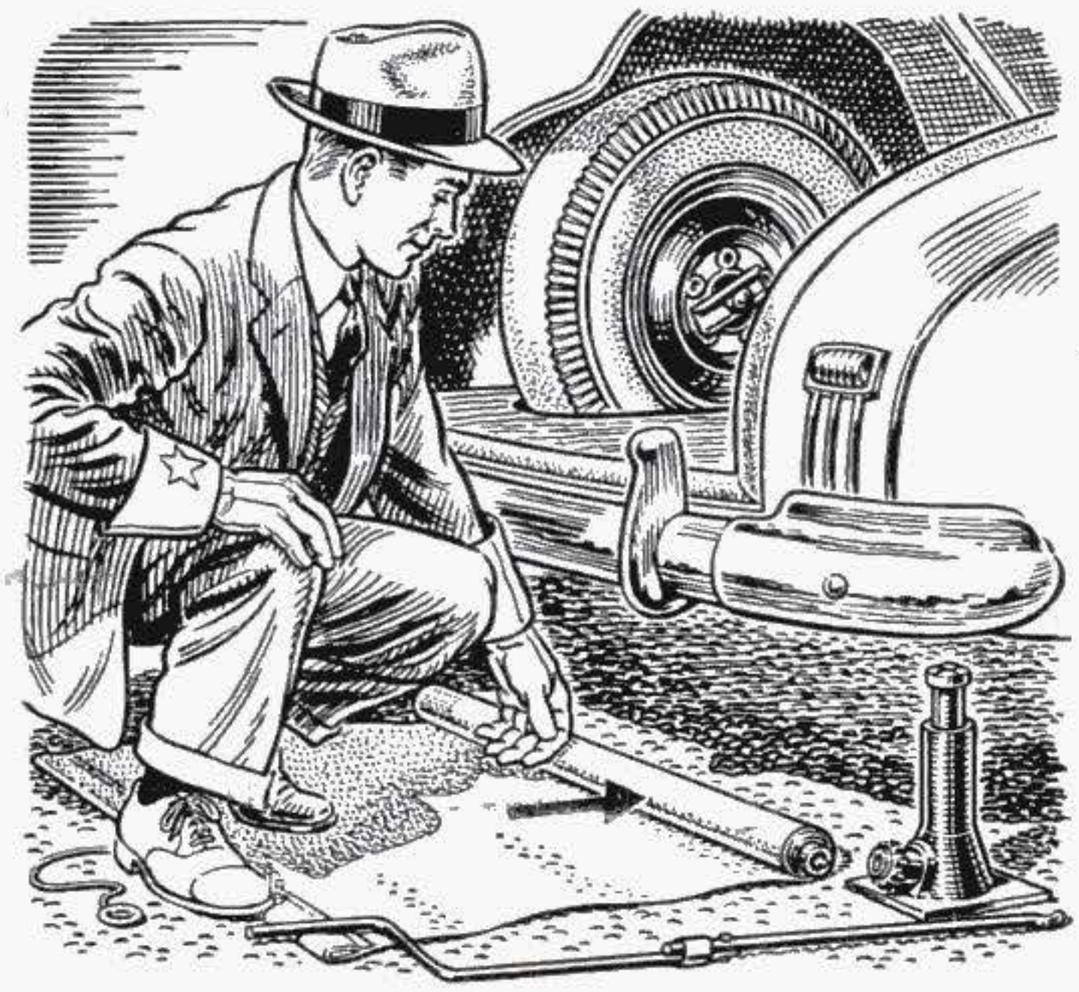
## MORE Hints from the Model Garage



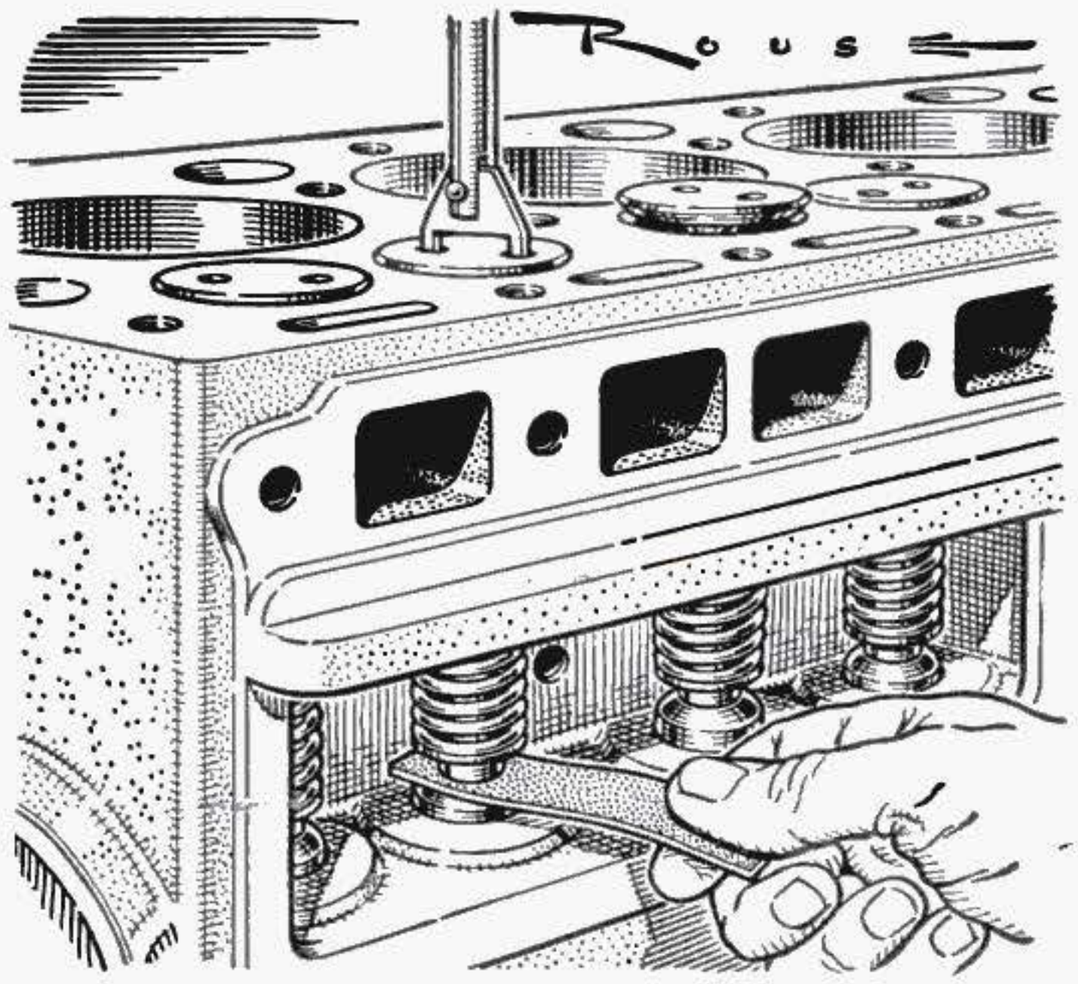
**Tool Cleans Fuse Clips.** This little tool quickly sands corrosion from the inner faces of a fuse clip. It's made by cutting a 3/16″ or ¼″ dowel to fuse length, gluing fine sandpaper around it, and gluing in a little wooden handle at the mid-point. To use, push the tool into the clip and flick the handle a few times.



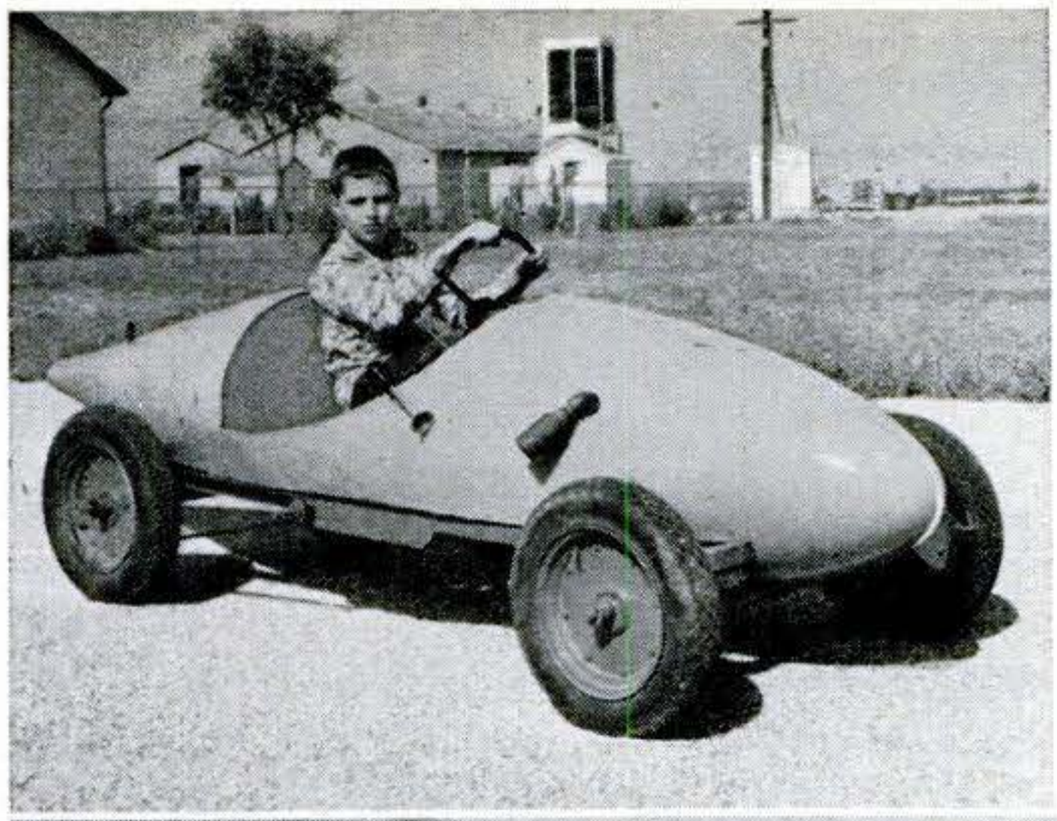

**Watch That Diaphragm Tab.** While installing a new fuel-pump diaphragm, be careful where you place the small protruding tab. A staple in this tab holds the layers together during shipment. Never locate the tab toward the filter bowl or it may keep the cork gasket from closing tightly. This would allow air to enter.



**Protecting Your Clothes.** For roadside emergencies when you're all dressed up and must crawl under the car, perhaps to set a jack, Clinton Casler, of N. Westport, Mass., suggests carrying a window shade in the trunk compartment. Unrolled, it enables you to crawl under with less chance of damage to your clothes. A pair of cotton gloves stored in a paper bag in the tool compartment is also a good idea.

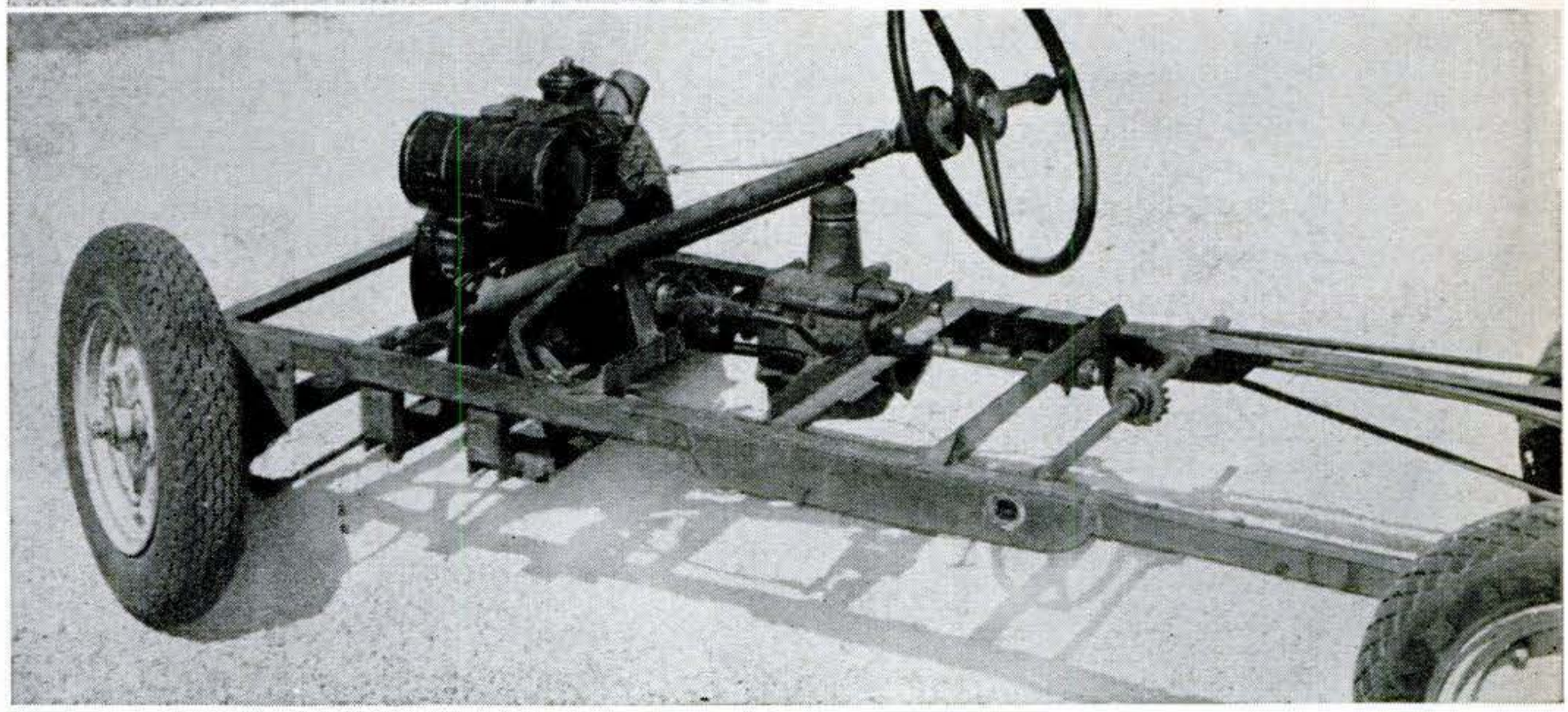


**Abrasive Adjusts Tappets.** If you should have to install nonadjustable valve tappets, Marion L. Rhodes, of Knightstown, Ind., suggests this procedure. First grind the valve stems close to the desired adjustment, leaving them slightly oversize. Then install valve and spring. To get the specified clearance between stem and lifter, insert a piece of abrasive cloth and rotate the valve. Check often until it's right.



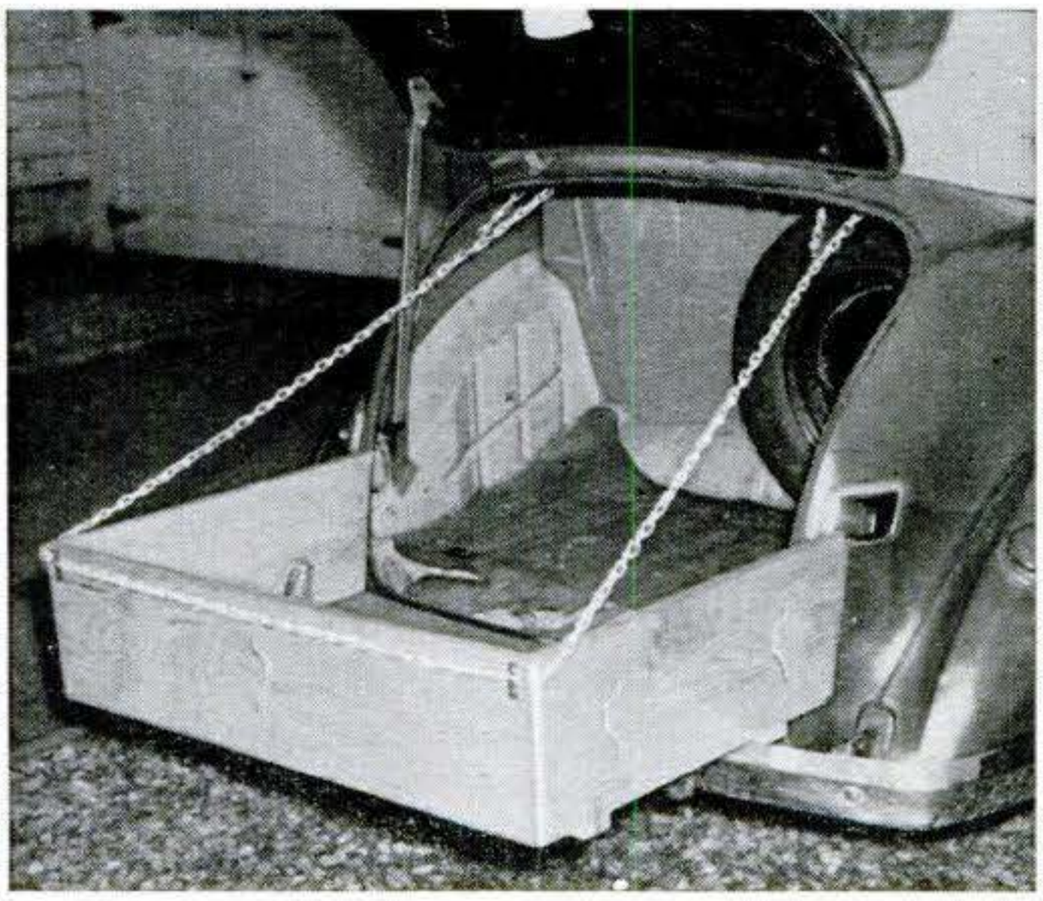
## Play Car Teaches Young Driver

To teach his son to drive, L. S. Robbins of Chickasha, Okla., built a play car for him with a gearshift, clutch, brake, and foot throttle that work like those in a big car. Robbins used a 1½-hp. Cushman motor, a V-belt clutch, a Model-A transmission, and a drive shaft brake from a Plymouth. Tires are 4.00 x 16. The body is an aluminum airplane fuel tank. The car's top speed is 15 m.p.h.—plenty fast for a beginner. Rear wheels are belt-driven, and slight belt slippage eliminates need for a differential.



## Extension Hauls Big Loads

With the trunk extension shown below, you can easily carry bulky loads. Made of 1″ by 12″ boards with a plywood bottom, the box rests on the bumper. The bumper guards stick up through holes in the bottom, keeping the box in place. Chains with snap fasteners support it as shown. Cleats on the side make it easy to lash a tarpaulin in place.—*Karl Greif, Binghamton, N. Y.*



## Car Carries Roof-Top Bed

On trips, Carl M. Miller, of Zion, Ill., never has to worry about hotel reservations. He carries his bed on top of his car. Made of ¾″ plywood, the platform is 4′ wide and 6′ long. The folding framework for the canvas tent and the ladder were formed from ½″ rigid conduit. The windows are plastic screening, and the window flaps are controlled from inside. The job cost $48.47.

# Educational Tricks Explain Car's Ignition

**You can "make" a battery, hydrometer, ammeter, and spark coil.**

***By Kenneth M. Swezey***

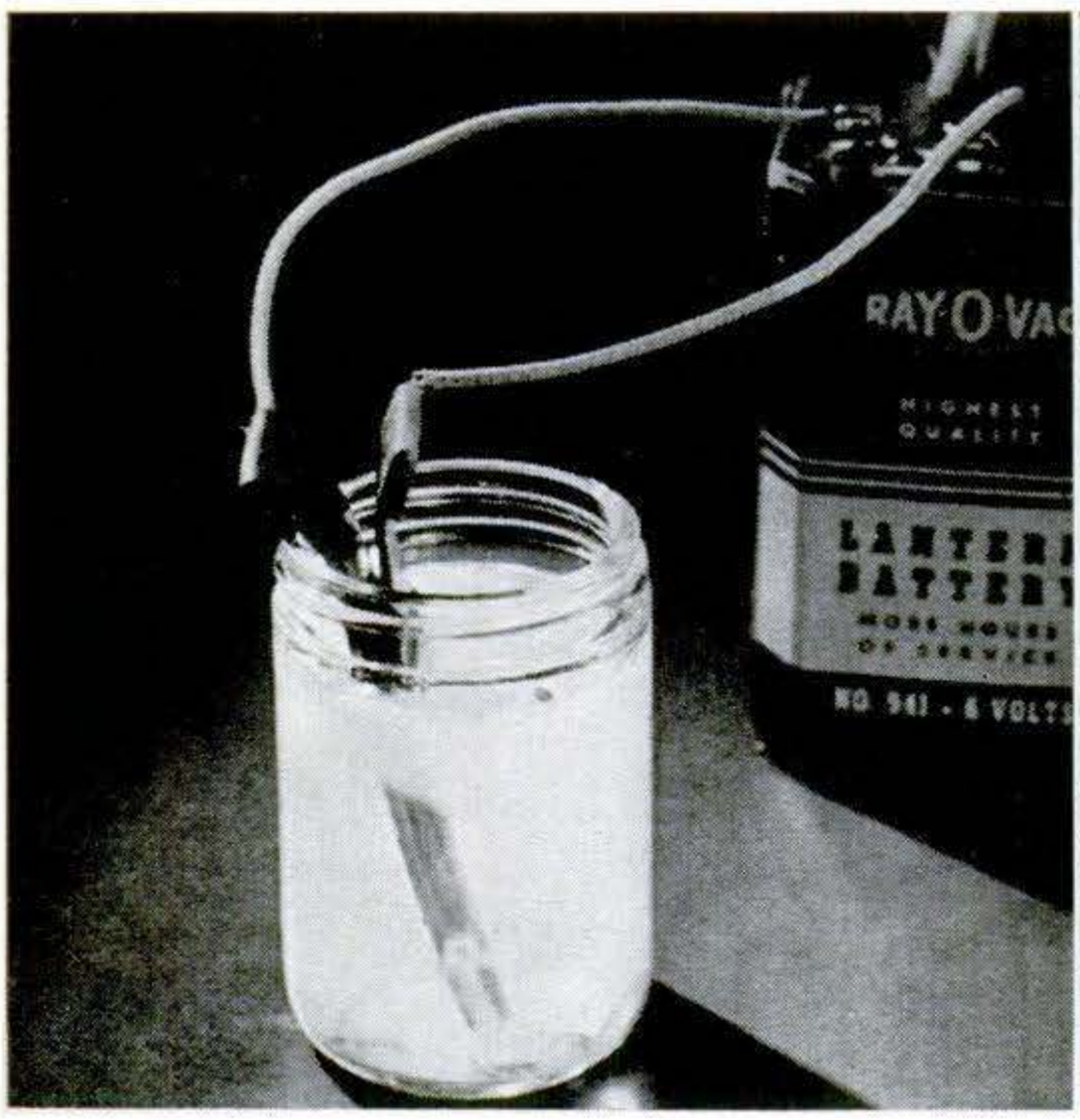
THE presto-chango stunts of the stage magician are trifles compared to what goes on in your car's ignition system.

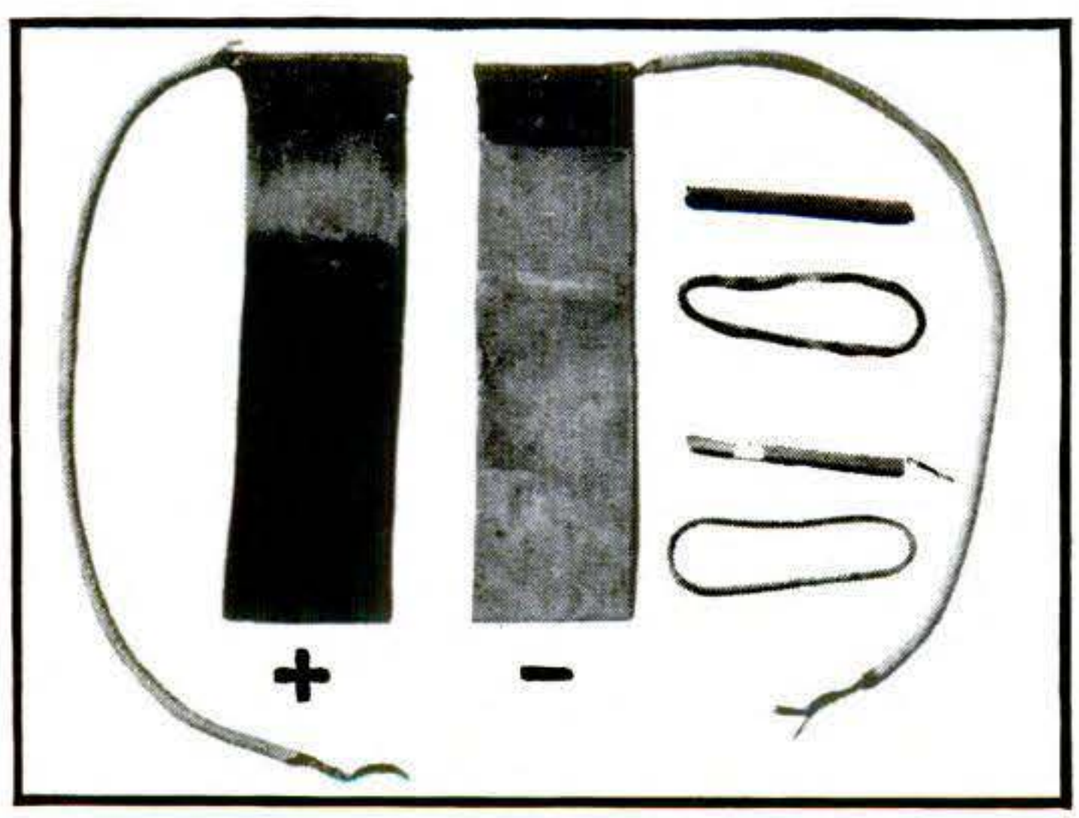
There, in the battery, you start with a chemical reaction that produces low-voltage electricity. This current, as it is, runs the starter, horn, lights, and radio. But you also wind up, via spark-coil sleight-of-hand, with 18,000-volt miniature lightning flashes in the cylinders.

Oddly, a storage battery doesn't really "store" electricity. It merely changes electrical energy into chemical energy and vice versa. Its cells contain sets of porous lead plates, one filled with lead peroxide and another with spongy lead, immersed in dilute sulphuric acid. When the battery is discharging, the sulphuric acid reacts with the lead peroxide, forming lead sulphate. When the battery is charging, the sulphate is changed back into peroxide, and sulphuric acid is restored to solution.

The usual three-cell battery gives six volts. But the action of one coil that has only a few turns of wire on another that has several thousand times as many boosts this voltage to put sparks in the spark plugs.

These setups "expose" this magic.






**An experimental storage battery** can be made in a jiffy from two lead plates (clean with sandpaper), two matchsticks to hold them apart, rubber bands to hold the assembly together, and a jar containing 1 part sulphuric acid in 9 parts water. (Caution: always pour the acid into the water.) To charge the battery, connect the plates for 5 minutes, as above at left, to 2 to 4 dry cells wired in series. During charging, oxygen is released at positive plate and hydrogen at negative. Some oxygen unites with positive plate to form brown lead peroxide. (Note its darkness in photo at the left.) To prove that the chemical change made by electricity can also return electricity, connect a flashlight bulb to the plates of your charged battery. The bulb lights as above.



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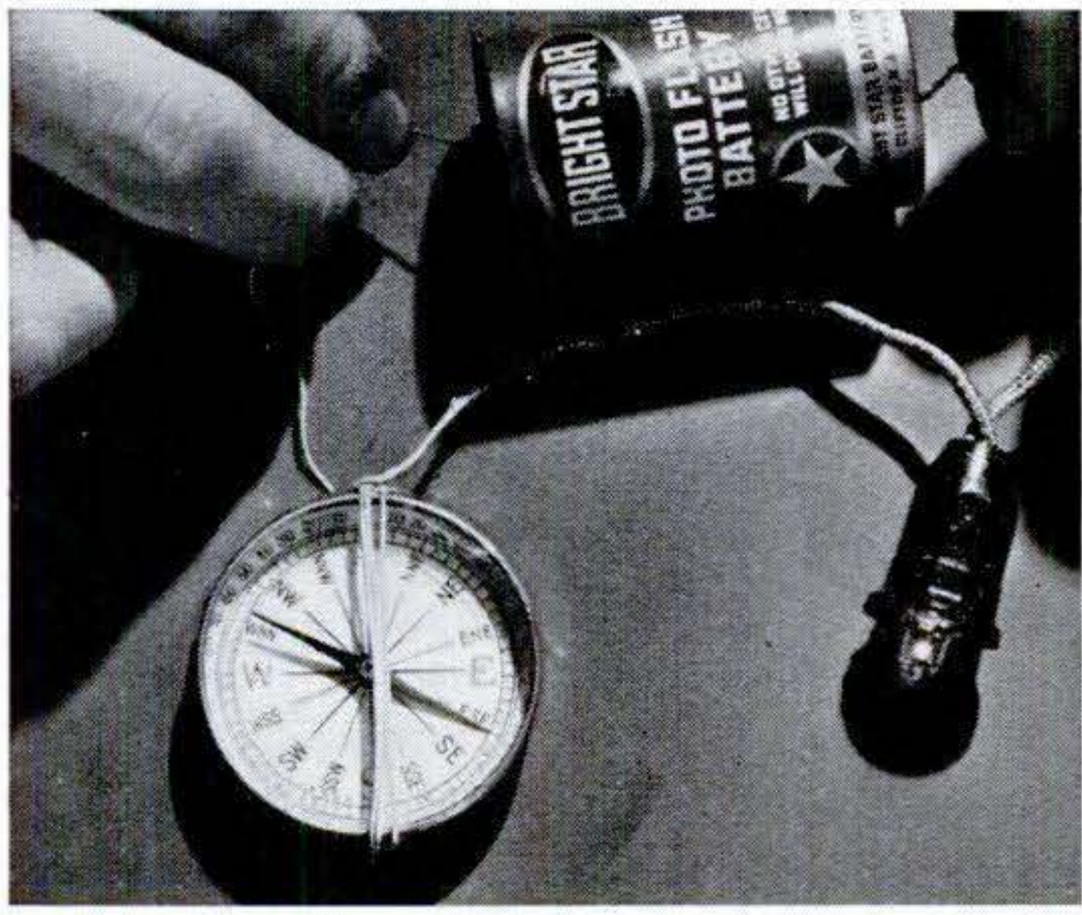
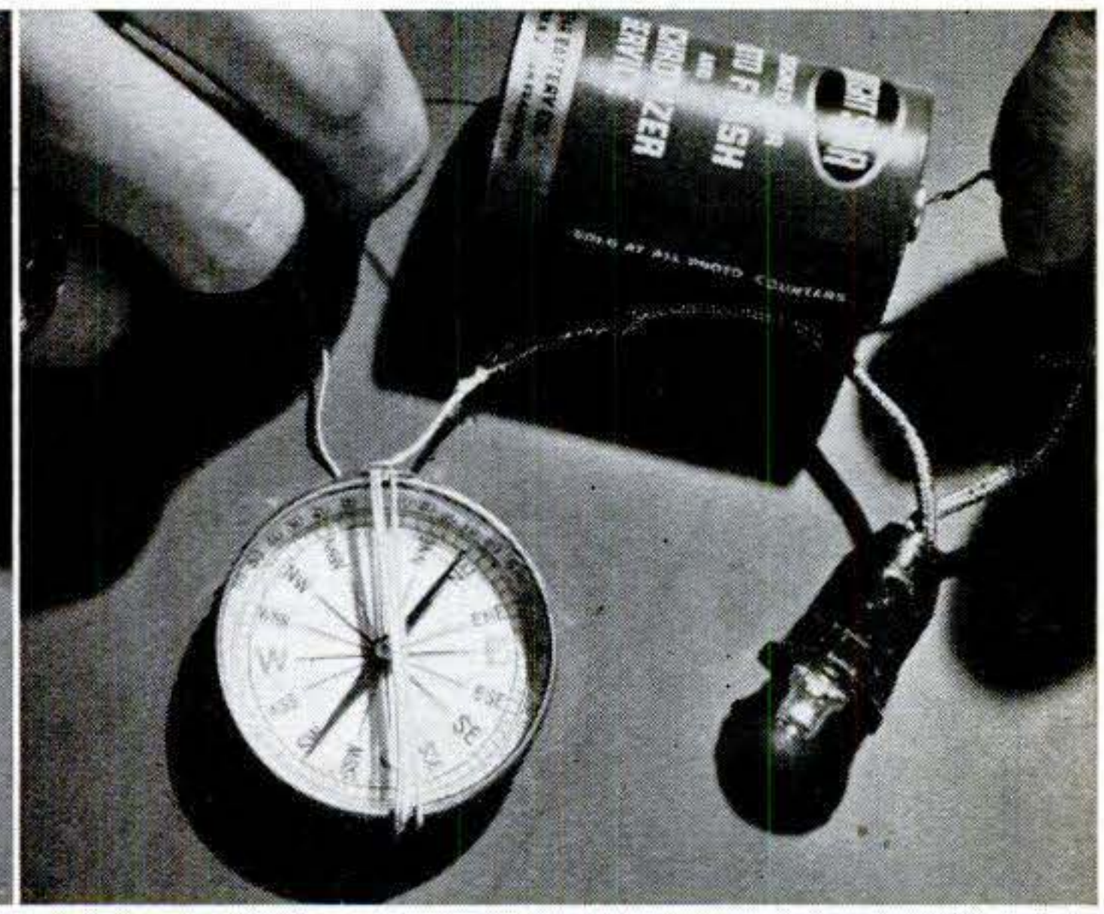
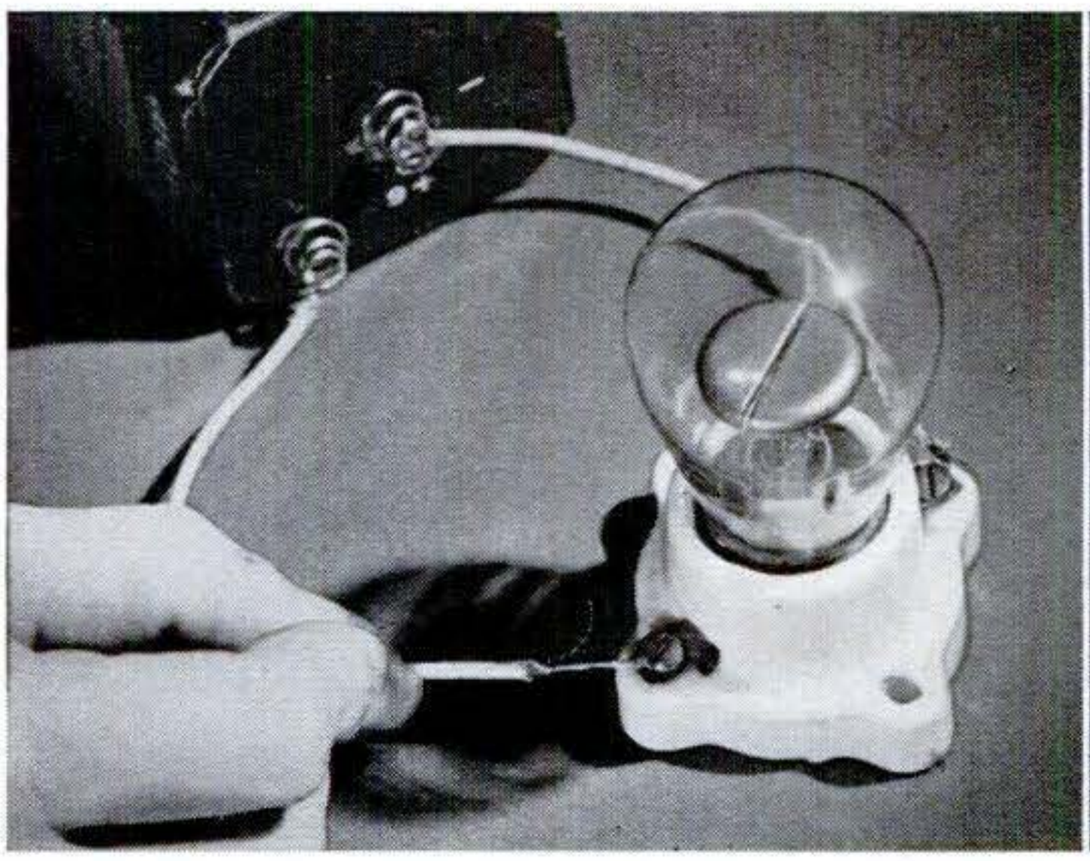
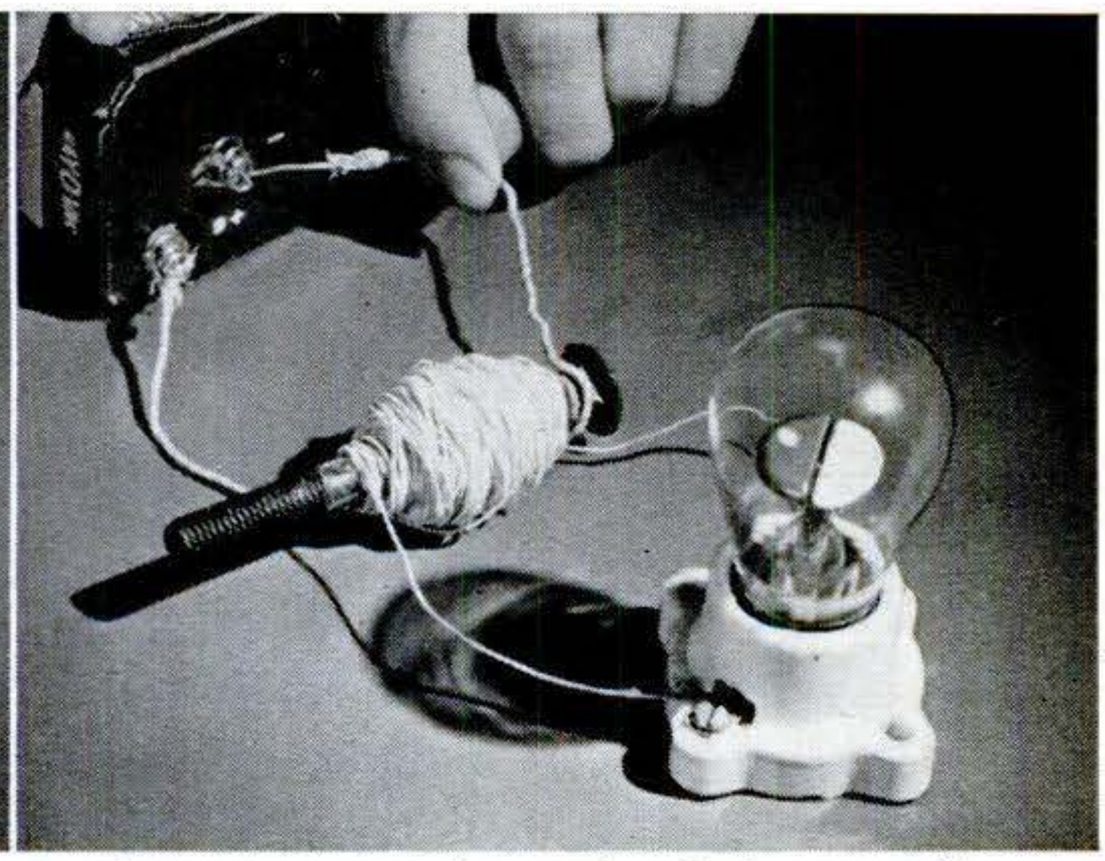
**How a hydrometer** indicates the state of charge in a battery can easily be shown. A hydrometer is a simple float-sink device for checking the density of a solution relative to that of water. Improvise one by weighting a small vial so it floats upright in plain water in a bottle. Mark the water level on a paper scale as seen at left. If you now slowly add sulphuric acid to water, vial will rise, as at right. When a battery charges, lead sulphate is changed to sulphuric acid. This increases the density, making the hydrometer float higher. On discharge, acid is removed, causing hydrometer to sink.



**An ammeter** keeps tabs on car battery circuit by telling whether battery is charging or discharging. You can show in principle how one works. Wind several turns of wire around a pocket compass. Then turn the compass so that needle is aligned with the turns. If you connect a flashlight cell in series with the wire and a bulb, needle will swing to one side, repelled by magnetic field set up in coil. Now switch connections to battery, reversing direction of current flow, and needle will swing other way. This is what happens in car's ammeter. When battery is charging, current flows one way; when discharging, current reverses.





**How a spark coil works.** Without a coil to increase the voltage, the spark plugs wouldn't spark. As a demonstration, connect a 6-volt battery to a small 115-volt neon bulb, left. The battery alone won't light the bulb.

Now make a simple step-up transformer. Anneal an iron bolt by heating it red hot and letting it cool slowly. Wind 20 turns of bell wire smoothly on the bolt as the primary. Over this wind 400 turns of finer wire as the secondary. Connect the ends of the secondary to the neon bulb. Touch the ends of the primary momentarily to the battery posts. Each time you break the battery circuit, high voltage will be induced in the secondary coil. This will light up the neon bulb.

The same thing happens in a car's ignition system. A rotor in the distributor breaks the battery circuit. High voltage induced in the spark coil sends a spark across the plug gap.



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# How to Pick Out a

***Gus suggests ways to identify disguised and how to estimate mileage***

Dear Bill:

You asked me about buying a used car. If I were doing it, I would buy only from a dealer with a good reputation. I would also inspect the car very carefully. I wish I could help you do this. But since I can't, I am attaching to this letter a few notes about things to look for.

If you go to a used-car lot, remember that many established dealers wholesale some used cars to the lots because it would cost too much to recondition them for sale with a guarantee. If a lot operator offers a guarantee, check it carefully. Also, ask him where the shop is that would make good any repairs for him.

There are two types of second-hand cars that you'd be smart to avoid - cars that have been in major crack-ups and former taxis. The wrecked car may look like new, but still have serious mechanical faults. The ex-taxi, even though a recent model, may have the life hacked out of it.

Don't trust the salesman or speedometer on mileage. Instead - as a rough estimate - multiply the car's age by 10,000. That's the average distance the average car goes a year. Don't let the car's looks influence you too much. Many shops buy used-car reconditioning kits that make old cars look like a million bucks. I heard of one the other day that even includes something to make a car smell new.

Don't just drive the car around the block. If you can, give it a real road test of 50 miles or so, including all kinds of road - level, rough, smooth, and some good hills. In New York, salesmen used to take prospects for a ride under the elevated tracks. The noise helped many a sale.

Unless you know the dealer, watch out for tricks! An over-full crankcase and extra heavy oil will often quiet a noisy engine. So pull out the dip stick and measure the oil



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# Good Used Car

***wrecks or former taxicabs, and use the "book" price.***

level. If it's too high, ask that it be lowered, and if the oil is heavier than #30, ask that a lighter grade be put in. A fast idle is another way of smoothing out a worn engine, so if the engine idles too fast, ask that it be set back to normal. Get out your gauge and check the tires, too, because soft tires can hide a lot of flaws.

After finding out what's wrong with a car, find out what repairs will cost. An engine overhaul is about the most expensive job you can run into. Fixing up a bad transmission or rear end or a loose steering gear or slipping clutch is also likely to cost real money.

Quite often a salesman will use the term "book price." The "book" is a pamphlet issued by the National Automobile Dealers Association, listing the average retail prices of all makes and models. These recently have been put out monthly. Regional variations in demand and supply sometimes make the book a poor reflection of a local market. But if the price quoted to you differs greatly from the book price, it's a good idea to find out why.

The book can help you in another way, too. It lists serial numbers by model years. By checking it, you can be positive of the age of the car you're considering.

Finally, before closing the deal, make sure that the numbers on the car agree with the numbers on the legal papers your state requires. And watch out if the numbers have been defaced. That may mean the car has been stolen.

Good luck!

Your friend,

Gus Wilson

***Turn the page for more tips on used-car buying***



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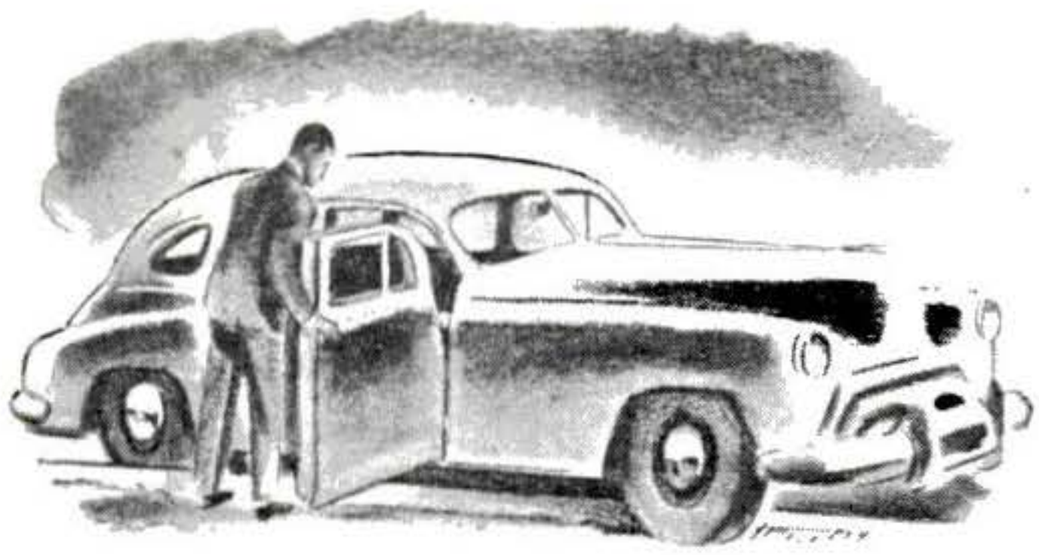
# Was It Wrecked?

**New Parts Are a Tip-Off.** Throughout your inspection, be alert for parts that are obviously new. New hood, grille, fenders, wheels, radiator core, bumpers, or frame-to-bumper members may indicate the car has been in a wreck.

**Do the wheels track?** Rear wheels should follow front ones squarely. You can tell by riding behind the car or watching as it is driven off. Also note whether the wheels wobble, which can be a sign of a bent axle.

**Welding or heat marks** on the frame mean it has been repaired or straightened. Check for this by crawling under or putting car on lift.



**Sticking doors** suggest that the chassis may have been twisted. Try them all. Also nose the car to the curb at an angle and ease one wheel over the curb. If doors now stick, a loose frame may be allowing the body to twist.

**Tires worn more on one side** of car than other suggest a sprung frame, bent axle, or loose wheels.

**Body or fender repairs** are another sign. Be suspicious of marks indicating a roll-over. Drum on body panels with your knuckles. If there has been extensive filling, the solder will cause the metal to give off a dead sound.

# Was It a Taxi?

**Badly worn upholstery** in a model only two or three years old indicates more than average use. If the car has seat covers, try to get a look at what's underneath.

**Roof patches** or worn paint may suggest that a taxicab roof light has been removed.

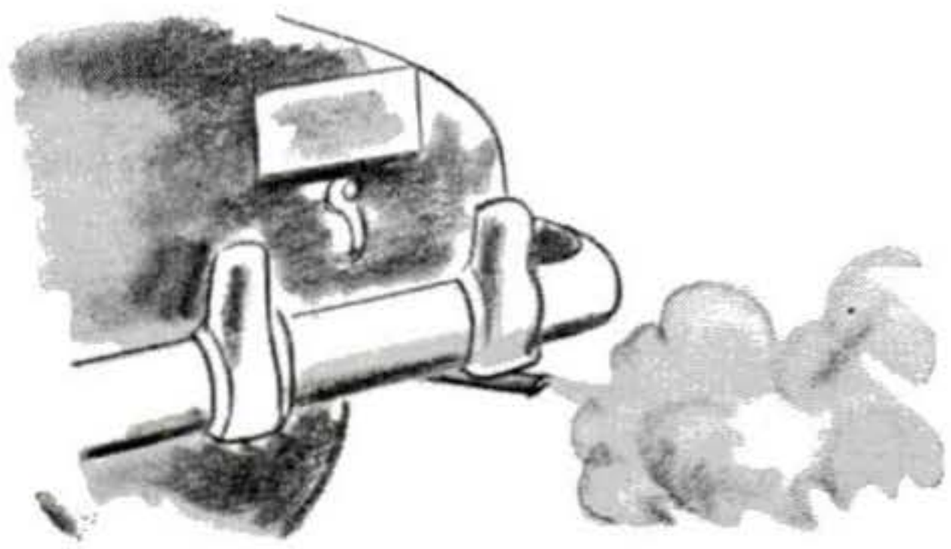
**New paint** may hide a former bright taxi color. Pry up the windshield seal or scratch down to bare metal on an inconspicuous part of the body to see if there's paint of another color. Has lettering on the doors been painted over?

**New pedal pads** or floor mat on a recent model may hide the hard usage of a taxicab.

# How's the Engine?

**Visual checks.** Examine the head and block carefully for indications of a crack or a welding bead. Any such sign is usually sufficient reason for turning your attention to another car. Are there rust spots on the radiator core? Such spots would come from a leak. Check the block for the same thing. A good fan belt normally lasts about 20,000 miles. Its condition, therefore, offers a rough guide to the car's mileage.

**Does it accelerate smoothly?** After dropping down to about 10 m.p.h. in high gear, accelerate quickly with full throttle. Observe whether the car gains speed smoothly and quickly without choking, sputtering, or bucking. If it does, the carburetion, valves, valve guides, and ignition are probably okay.



**Does it need an overhaul?** After the engine has warmed up, race it with short, heavy thrusts on the foot throttle and watch for clouds of bluish-white smoke from the exhaust. This indicates the need for new rings—or perhaps new pistons, bearings, or a cylinder rebore. Black smoke is a sign of a badly adjusted carburetor. If the smoke is black, have the adjustment made and check again. As a further check, look for oil around the spark plugs. Remove a plug and note its color. If it's black instead of a normal brown, the engine probably burns oil. If the oil pressure remains low, the engine is worn or the oil pump out of order.

An engine overhaul is one of the most expensive car-repair jobs.



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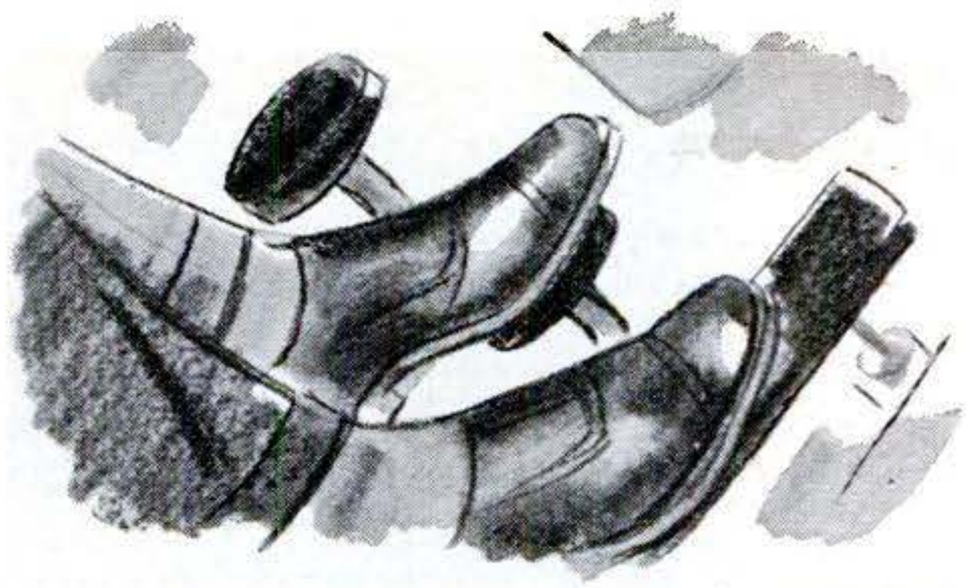
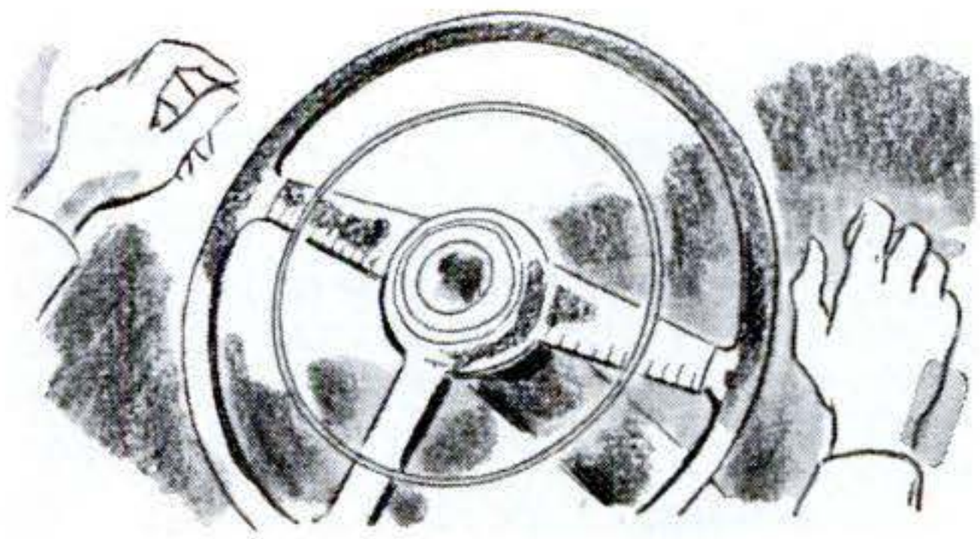


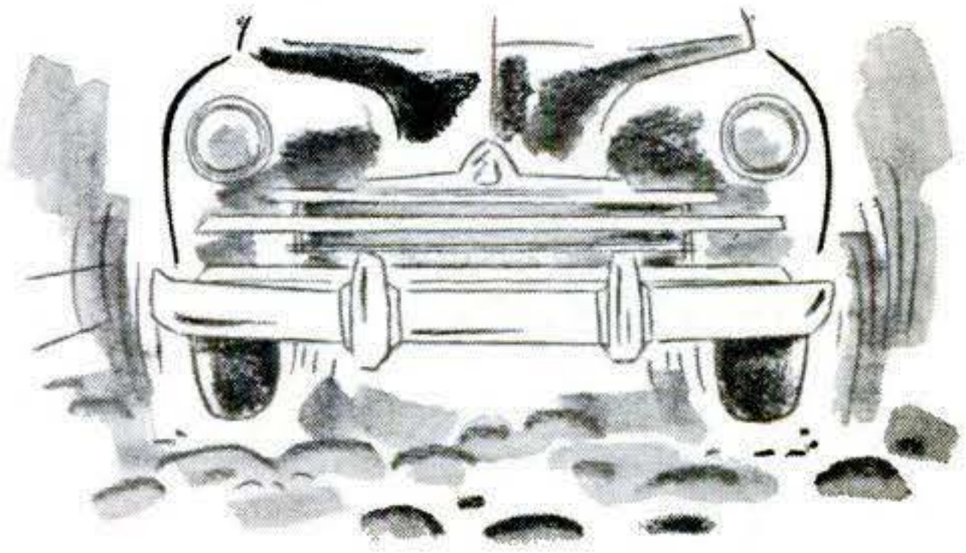
**Are the bearings faulty?** While moving at about 15 m.p.h., slowly apply the brakes with your left foot, and simultaneously feed an increasing amount of gas with your right to maintain speed. Don't stop the car with the brakes until the throttle is clear down. Disregarding the carbon or spark pinging, listen for a muffled, hollow knocking. If the muffled knocks are even, the bearings are all in the same condition, probably okay. A loose bearing will knock more loudly.

## *Steering?*

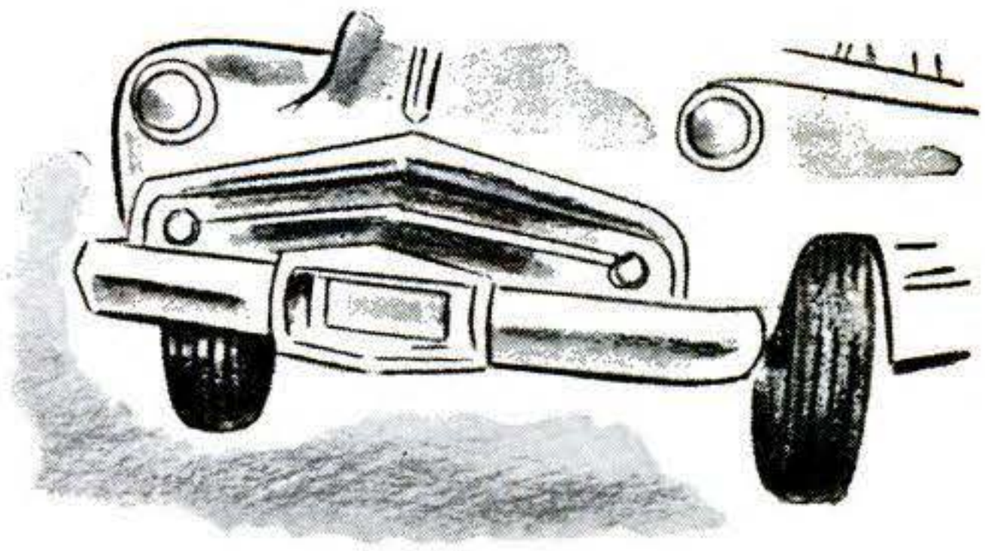
**Are the wheels loose?** Grab a front wheel at the top with both hands and try to move it back and forth in the vertical plane. Can you feel any play, even the slightest? Do you hear a faint sucking noise? The first is a sign of a worn kingpin bushing, the second of a loose wheel bearing. (A damaged wheel bearing makes a clicking sound while the car is in motion. This click becomes more noticeable while you are passing a concrete retaining wall.)



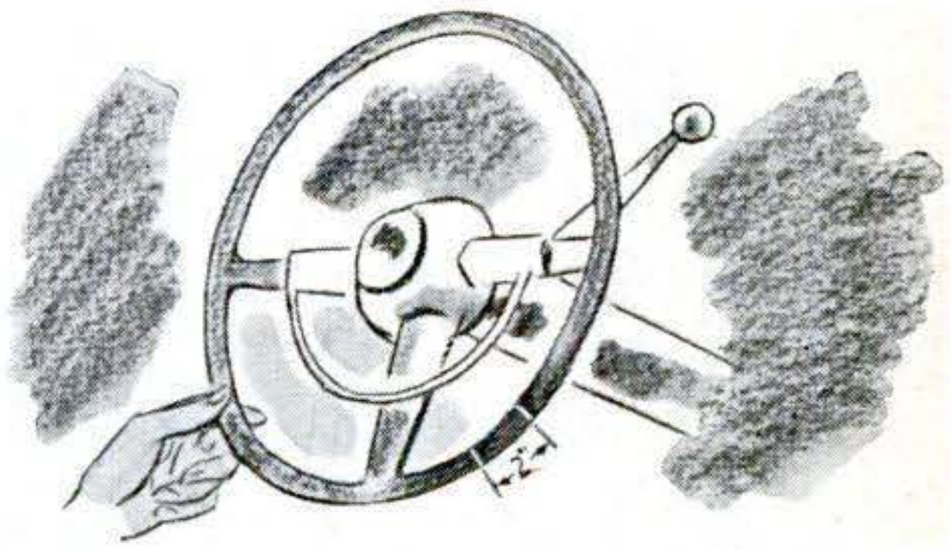
**Does the car veer to the side?** On a straight flat road, without noticeable cross wind, speed up to about 25 m.p.h. and take your hands from the steering wheel. The car should travel 100 yards or so without any tendency to turn. Try this several times. If the car turns to the same side on each test, the wheels may be out of alignment. A sagging spring or bent axle or frame (also wreck signs), however, can have the same effect. Should the car veer sometimes to one side and sometimes to the other, loose steering connections or worn kingpins may be to blame. Have a mechanic find the cause.



**Do the wheels shimmy?** Drive over a rough pavement, the rougher the better. If the wheels shimmy, it may come from at least a half-dozen causes. Repairs are liable to be troublesome and can be costly.



**Do the wheels bind?** Driving very slowly, turn the car sharply right and sharply left to the full limit. If the steering gear binds, someone probably has attempted adjustment to compensate for wear. Such a car can be dangerous to drive.



**Too much steering-wheel play?** With the tires evenly inflated, point the front wheels straight ahead and grasp the steering wheel with the thumb and forefinger. How far can you turn it without moving the front wheels? If the play exceeds two inches, the steering mechanism is too worn or loose for safe driving. Adjustment may be possible, but replacement is expensive.

**Are the tires unevenly worn?** Spotty wear on the front tires often comes from wheels out of alignment. So does "feathering"—a thin projection of rubber on the edges of the tread



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blocks. Check all tires, including the spare. Improper camber and toe-in cause such wear.

## Brakes Good?

**Does the hand brake hold?** Try it on a steep hill. If it doesn't, a simple adjustment of the linkage may overcome the difficulty.

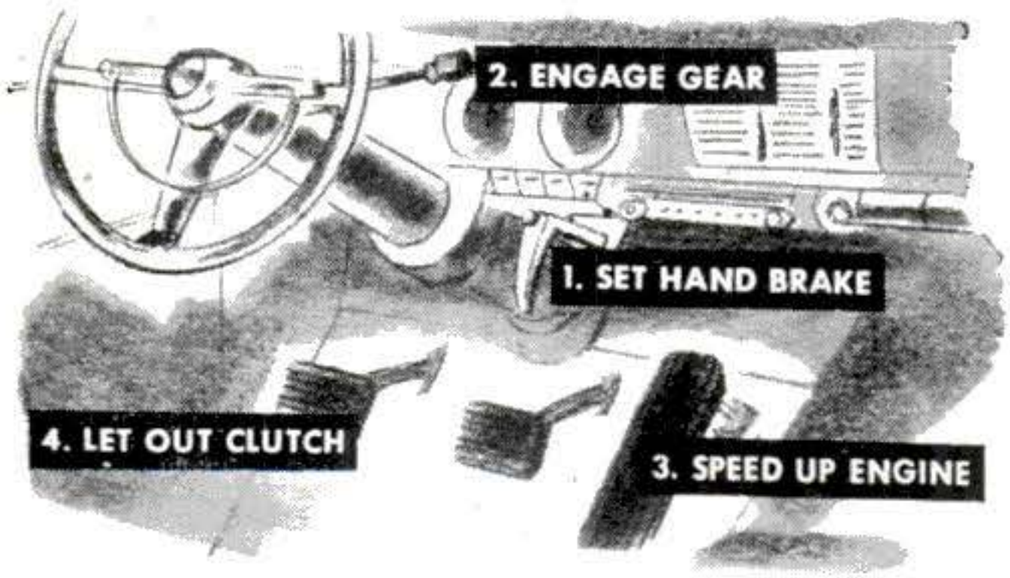
**Does the pedal soften?** With the car at a standstill, depress the brake pedal as far as possible and hold it that way at least half a minute. (It should not go closer than 2" to the floor.) If the pedal tends to sink, the cylinder pistons are probably worn, permitting hydraulic fluid to leak past.

**Is the pedal spongy?** Apply and release it several times to find out. If so, there is air in the lines or the cylinders are bad.

**Does braking swerve the car?** On a straight, level road, apply the foot brake hard several times and note whether the car has any tendency to swerve. If it does, one possibility is a defective oil seal, permitting linings to become saturated. Get an estimate from a brake shop.

## Power Train?

**Clicks in the drive shaft?** Jerk the car a little by taking your foot off the gas pedal and then jabbing it back while moving at 10 to 15 m.p.h. Do you hear clicks or the sound of slack being taken up? It may indicate looseness in the universal joint, differential, or rear-axle shafts.

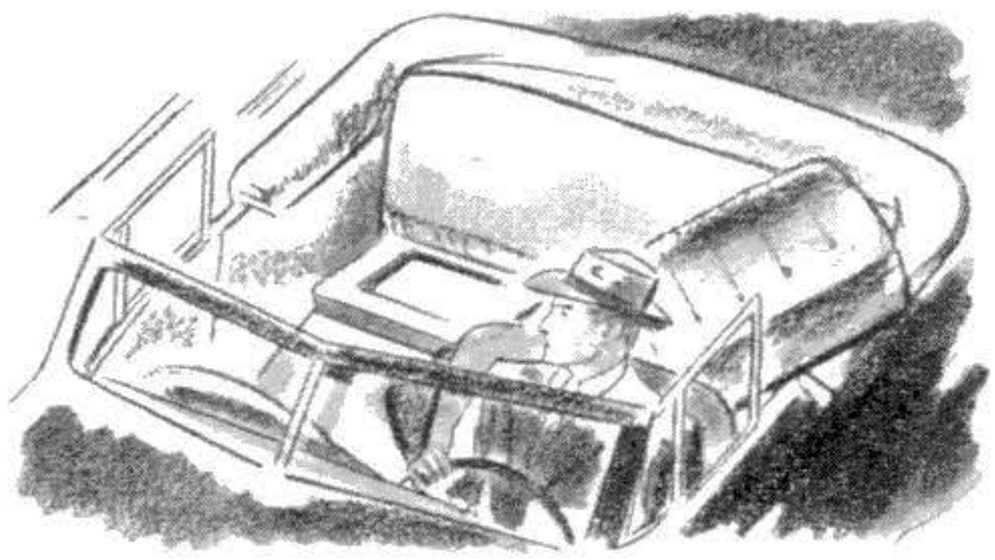



**Does the clutch slip?** A clutch pedal should have at least half an inch free play at the top. Check it with your hand. If you can detect no play, the clutch is probably slipping. Check by setting the hand brake hard, putting it in second gear, speeding up the engine to a fast idle, and slowly letting out the clutch pedal. The clutch is slipping if the engine does not stall promptly. The slipping is certain to become worse, finally demanding a complete clutch overhaul. Also try the clutch in normal driving. If it grabs—takes hold so quickly that the car jerks or shudders—the facing probably is badly worn.

**Is the transmission worn?** Shift into low gear and speed up quickly to about 20 m.p.h. If the gears are badly worn or the teeth burred, the transmission will howl or grind. (This same test will also show up bad engine bearings.)

As a further test, go down hill in high and second gear with your foot off the gas; a worn transmission may clatter. Repairs come high.

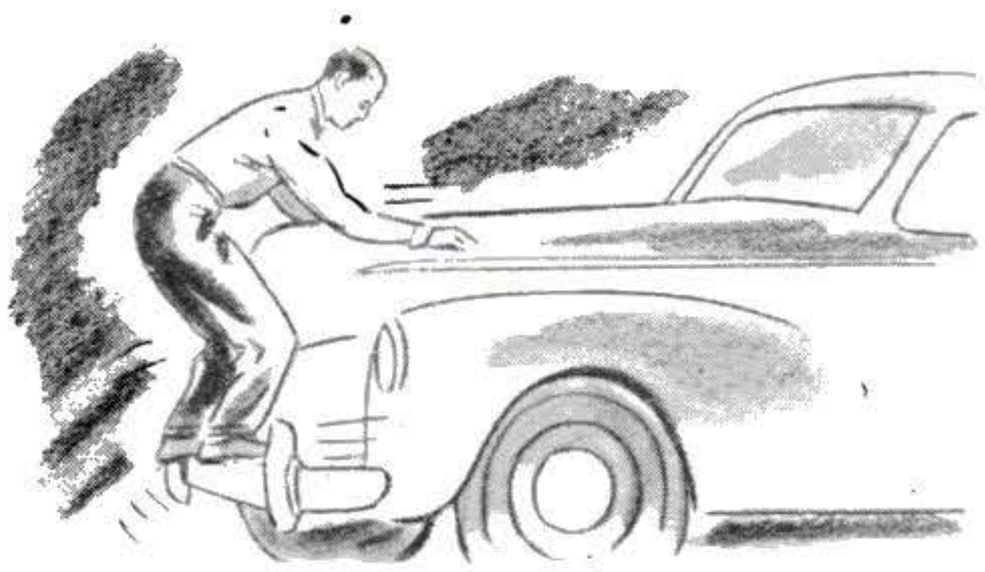
**Automatic transmission noisy?** Many of the automatic or semiautomatic transmissions have now been on the road long enough to reach the used-car class. If you encounter one, give it a thorough trial at all speeds. A high-pitched singing sound is often a tip-off to coming trouble.



**Noise in the differential?** To check the rear-axle assembly, ride in the rear seat or, better still, remove the rear-seat cushion. On a smooth road (preferably a smooth blacktop to lessen tire noise), pick up speed slowly and evenly to about 50 m.p.h. with your ear cocked to the rear. Then shift into neutral and coast to a stop. Should you hear any grinding, knocking, or hum from the rear end, a heavy repair bill may be in the offing.

## Don't Forget...

**Test the starter.** With the ignition off, press the starter button for about ten seconds. Repeat several times. Any pronounced grinding or clashing means that teeth in the flywheel starter gear are broken, burred, or badly worn.



**Test the shocks.** Jounce on the front and rear bumpers. If the car continues to bounce after you jump off, the shocks need repair, or perhaps replacement. (This also tests the bumpers themselves for tightness.)

**Test the ammeter.** When you speed up the engine, does the needle move at least a little to the charge side? If not, the generator, regulator, or battery is defective.

**Test the lights.** Depress the brake to check the stoplight. Step on the gas and notice whether the lights brighten considerably. If so, the battery may have been spiked with acid.



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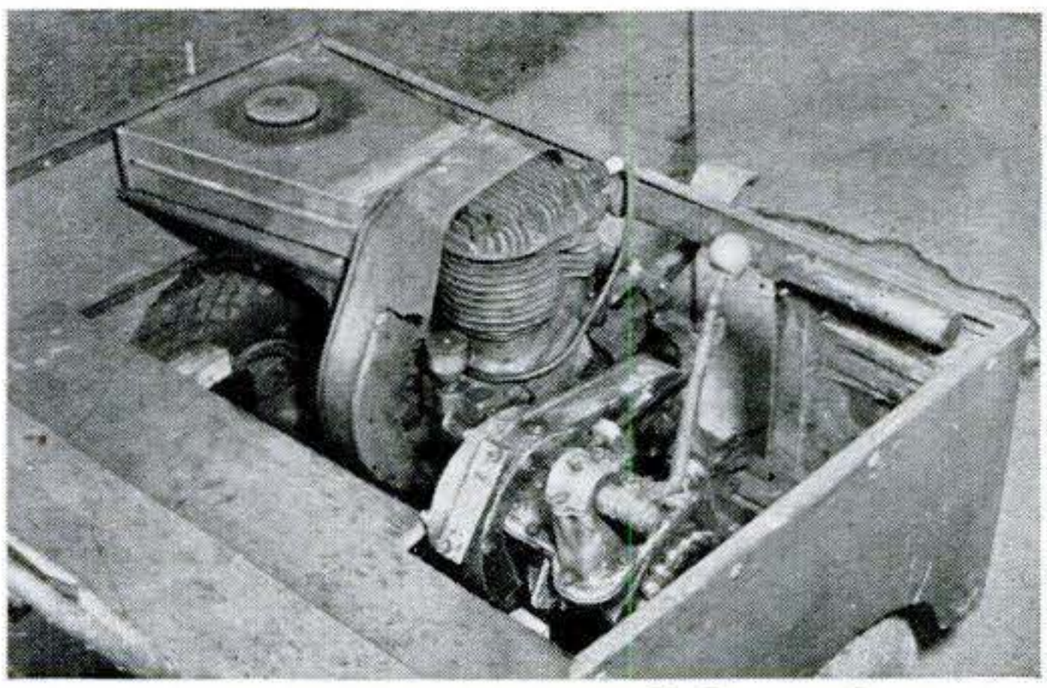
# Grownups Put This Toy to Work

**The tiny car** is a natural for daily shopping chores and short trips. Seat has room for a passenger, laundry bag, or parcels. Car has motor-scooter wheels.

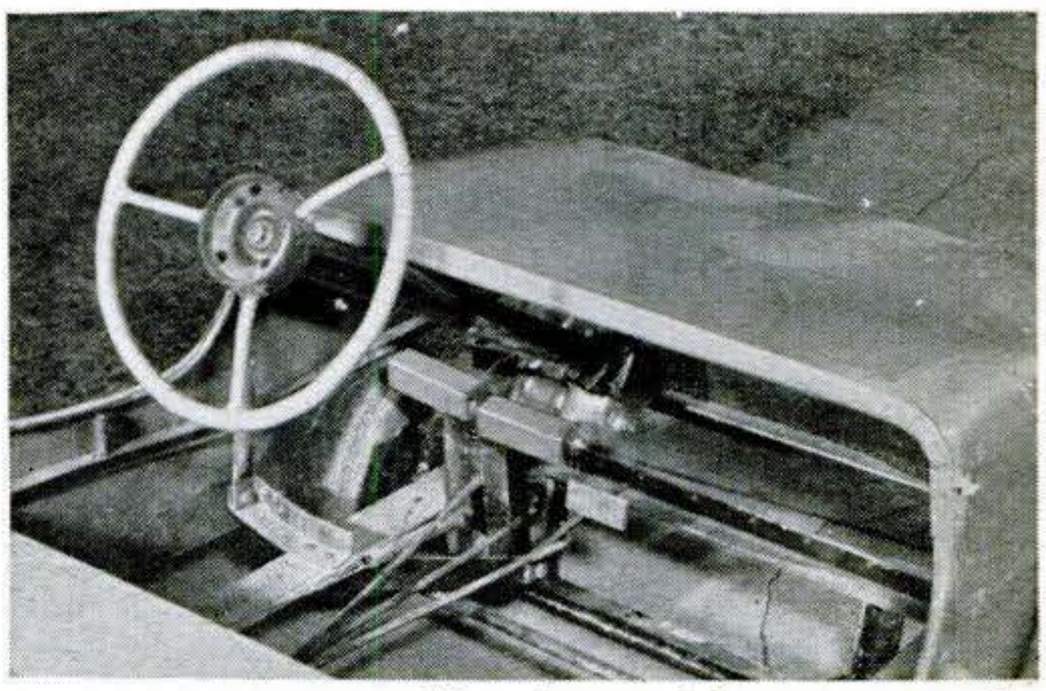
IT COSTS you gasoline when your wife runs an errand in the family bus. As an economy substitute, she might go for a midget car like this one, built by Paul E. Matous, of Orangeburg, N. Y. With it, a gallon of gas would cover a week of gadding around.

Actually, Matous built the midget for a friend's 10-year-old son. But the grownups soon took it back. It proved too speedy and tricky for the youngster.

Built on a 41″ wheelbase, the car is 60″ long and 37″ wide—small for an adult, but you can cram yourself in.



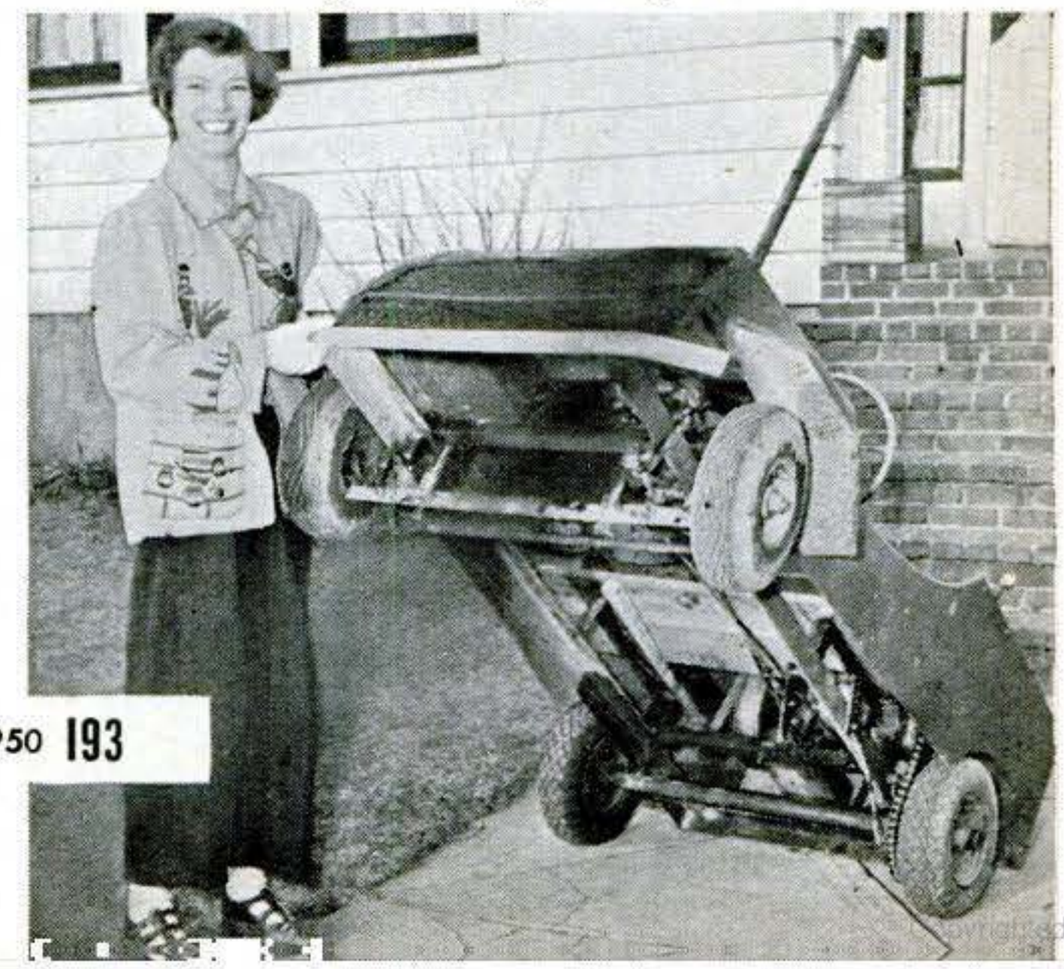
**Motor-scooter engine** is coupled to Indian motorcycle transmission. A chain drives one rear wheel. You shift gears with lever behind you.



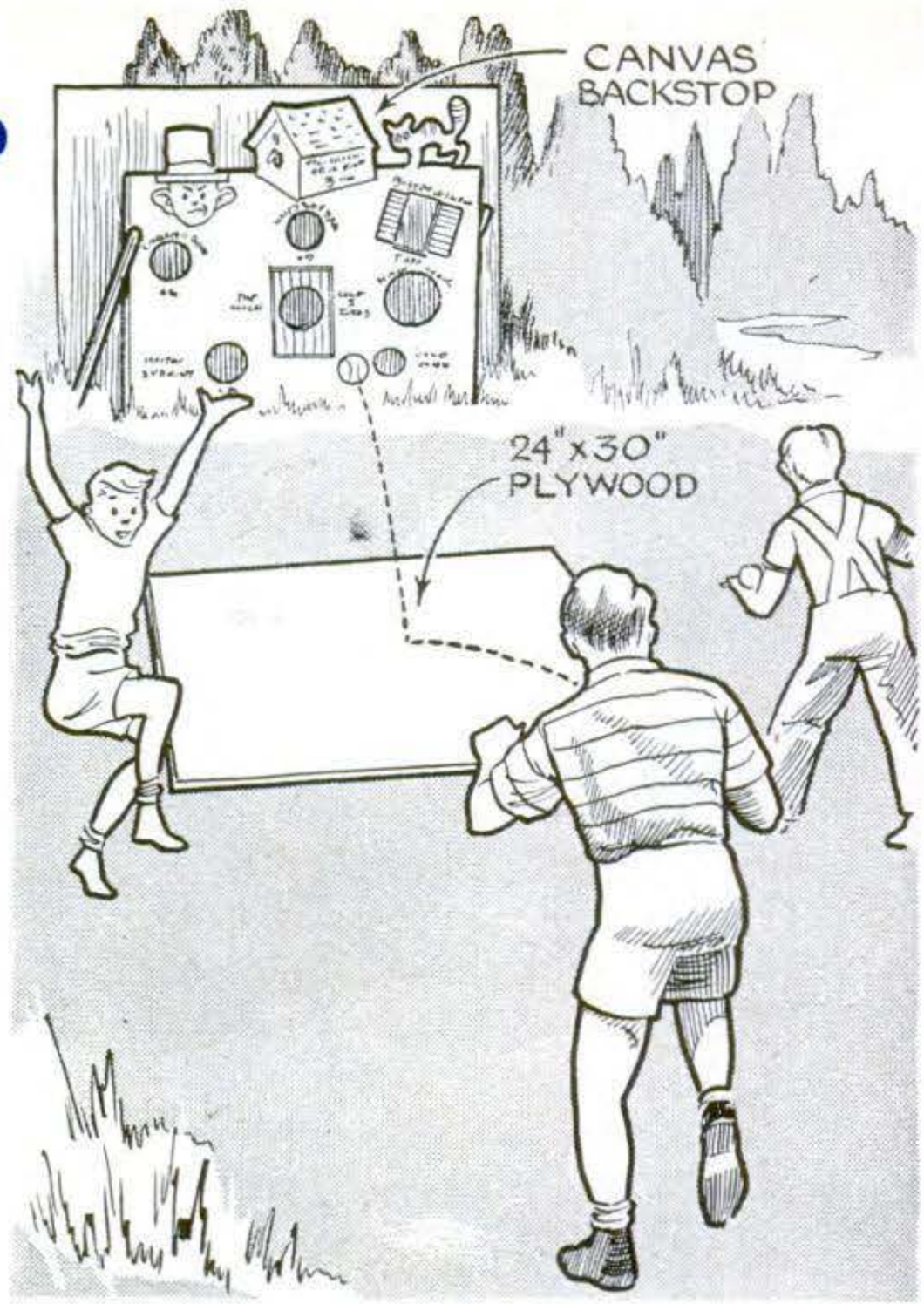
**The pedals work** like those of big car. Brake operates mechanically on a rear wheel. Steering gear is from a Ford. Frame is angle iron.

**Kick pedal** starts 4-hp. Cushman engine. The car gets up to about 45 m.p.h. and will cover around 40 or 50 miles on a gallon of gas.

**There's no reverse gear,** but don't worry. Anyone can pick this car up and whirl it around. And it can be parked right at your door.



# Back-Yard Fun for a Craftsman's Son

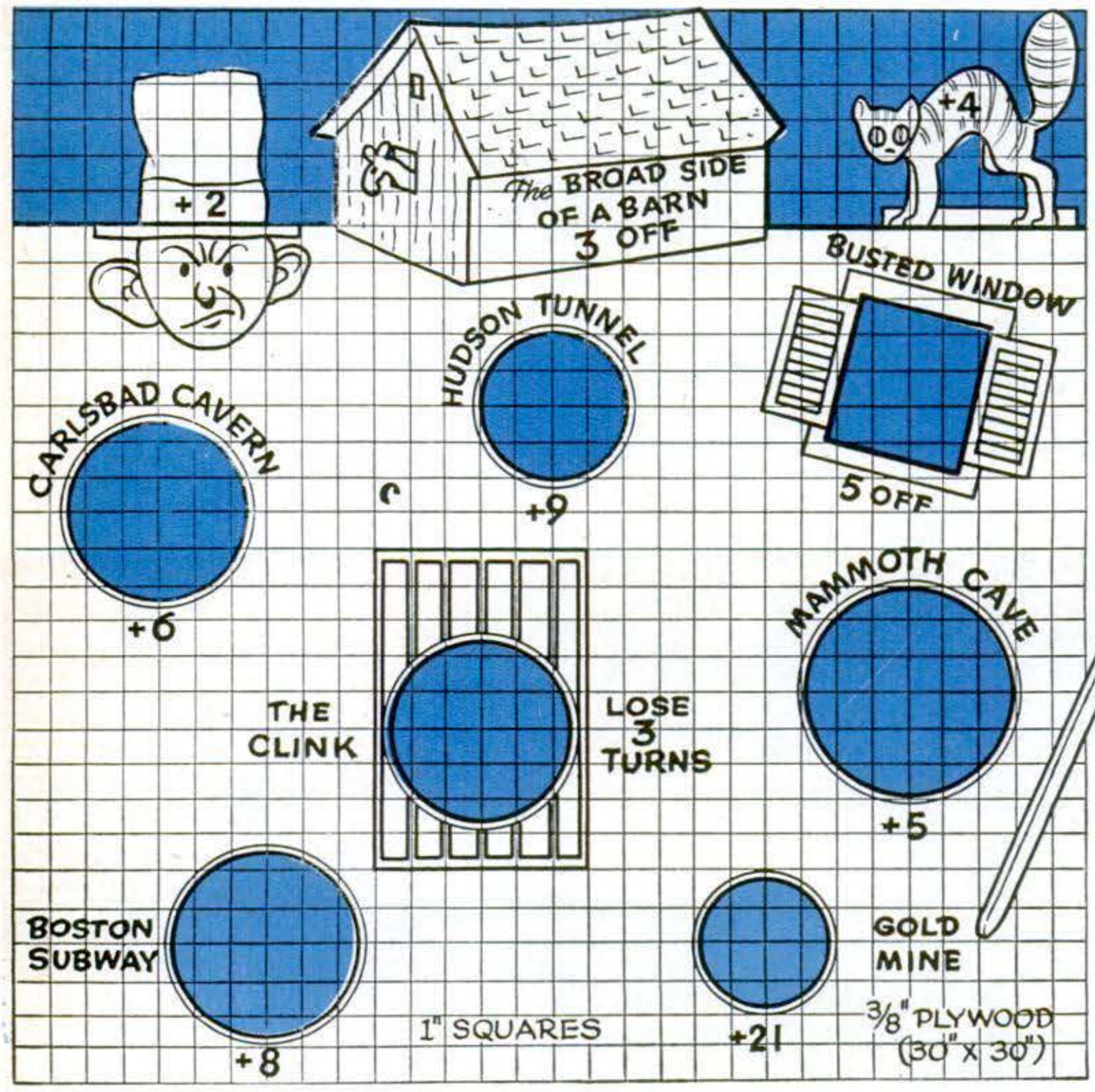


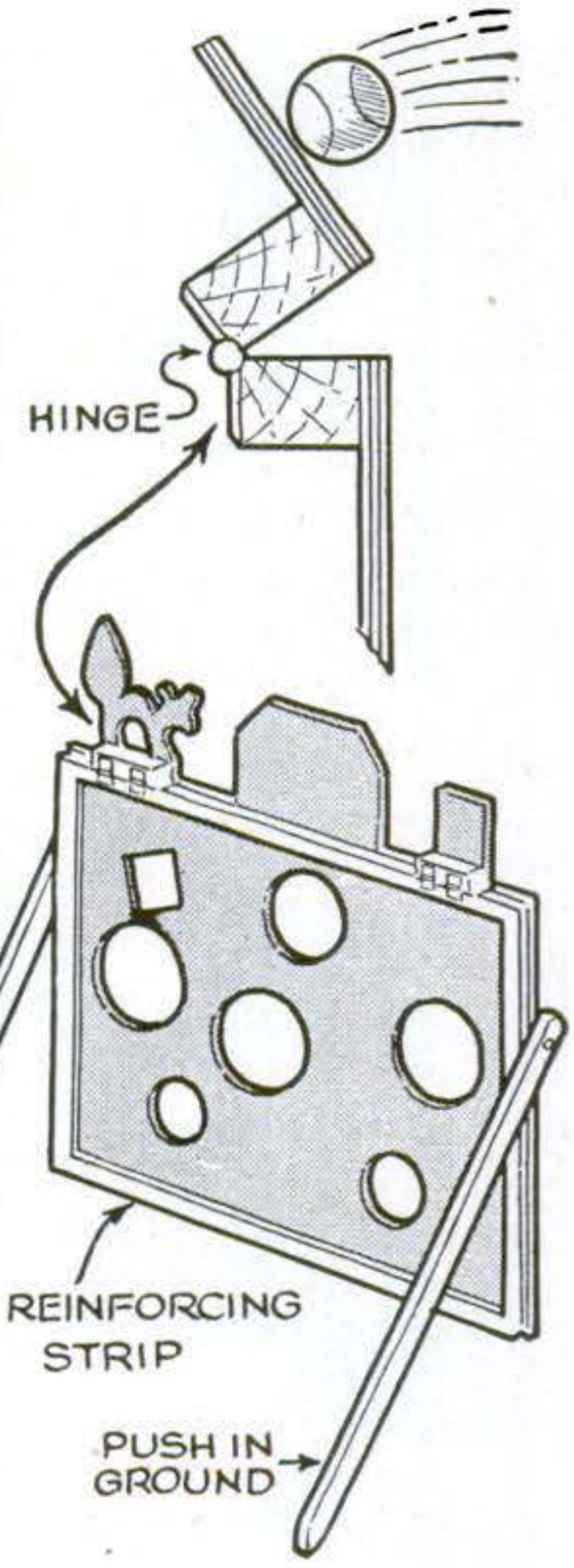

HOW accurately can you bounce a tennis ball at a target? This back-yard or beach game offers you a chance to find out. You will have to be pretty good to pile up a winning score without busting a window or landing in the clink.

The target consists of a ⅜" plywood panel with seven openings cut as indicated. Saw the barn in silhouette. Hinge the cat and hat so they will swing back when hit. Ring the openings with paint, and paint the designs, legends, and scoring numbers directly on the plywood.

For playing the game, 20′ is a good distance. Place the 24" by 30" bouncing board two-thirds of the way to the target.

If you hit the side of the barn, or miss the board altogether, subtract three from your score. If you hit the board elsewhere, without going through an opening, your score stays put and the next player takes his turn. The first to score 50 points wins the game. —*Hi Sibley, Nuevo, Calif.*



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Smartly designed in mahogany and walnut, this family desk is a convenient size for a small home. It has a natural grain finish.

# How to Build a Modern Desk

**By Roland Cueva**

HERE'S a modern desk with ample drawer space and an extension leaf to add to the working space. I built this one of walnut and mahogany, but less expensive woods can be used and the desk enameled to match your interior decoration.

***Top.*** It's not large as desks go, measuring 22″ by 42″, but the extension increases the work area to over 56″ in length. Random-width pieces of ⅞″ walnut, doweled or splined and glued together, make up the top. The edges are beaded or molded to suit. A walnut frame, ⅞″ by 1¾″, is fastened beneath the top with screws and glue. This gives the appearance of a top 1¾″ thick. The frame is left open at the left end, the end of the sliding extension board forming the fourth side when it's closed.

***Pedestal.*** Right and left side of this part are ¾″ by 4¼″ mahogany frames. Walnut panels, glued up from various widths, fit into the rabbeted frames. The front edges of the frame are cut in slanting steps for



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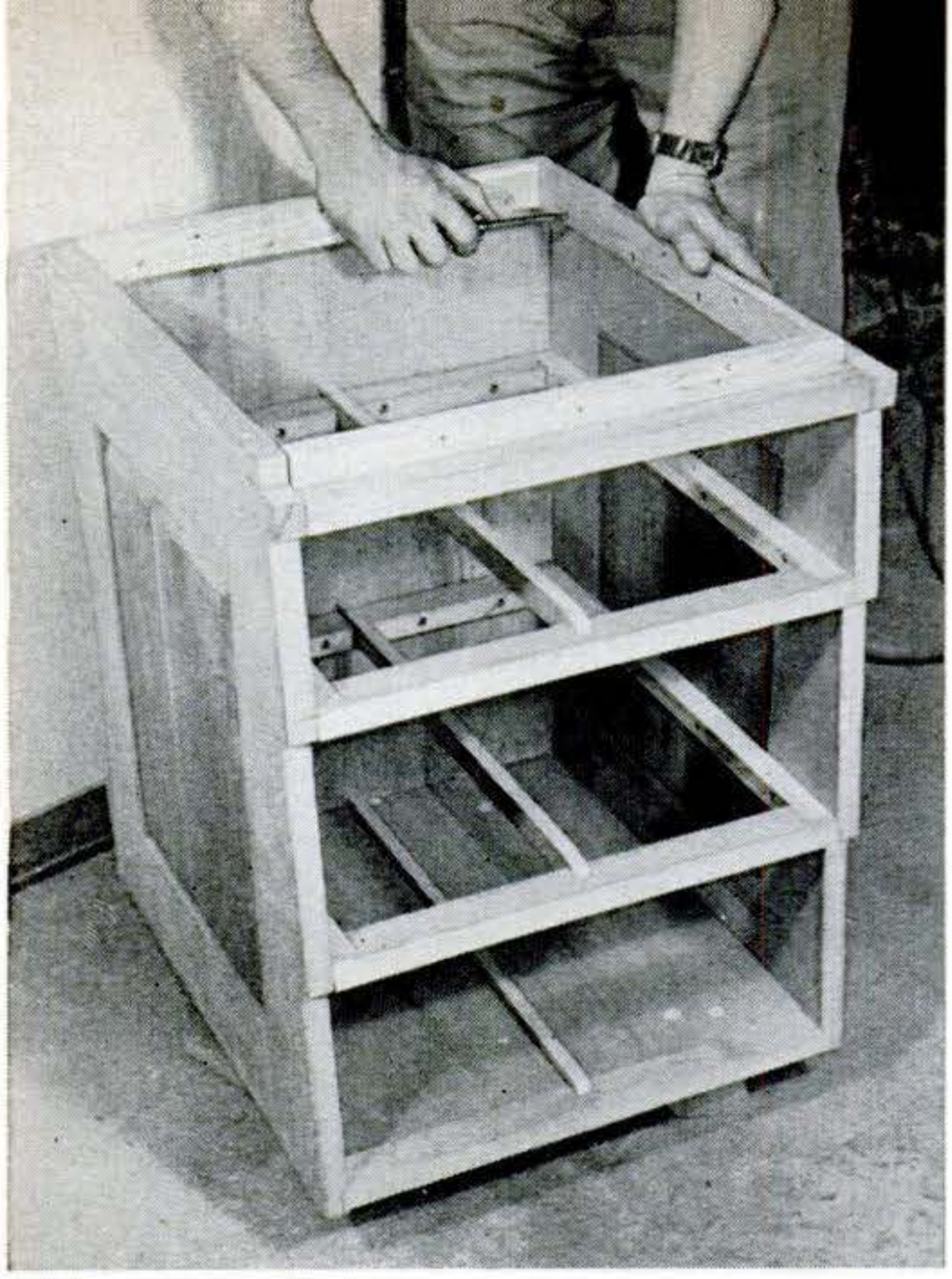
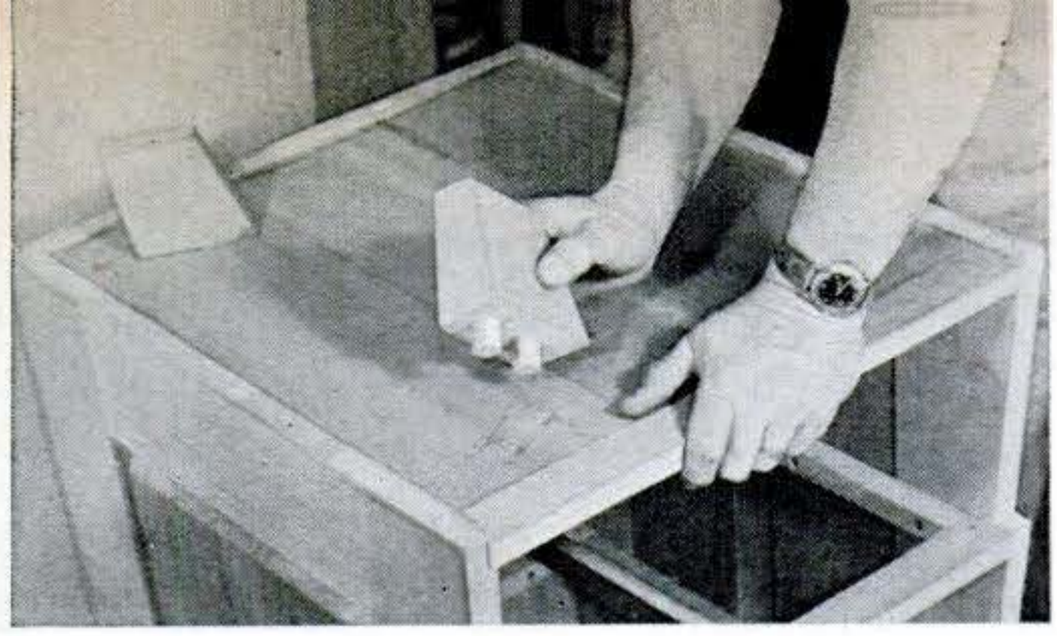
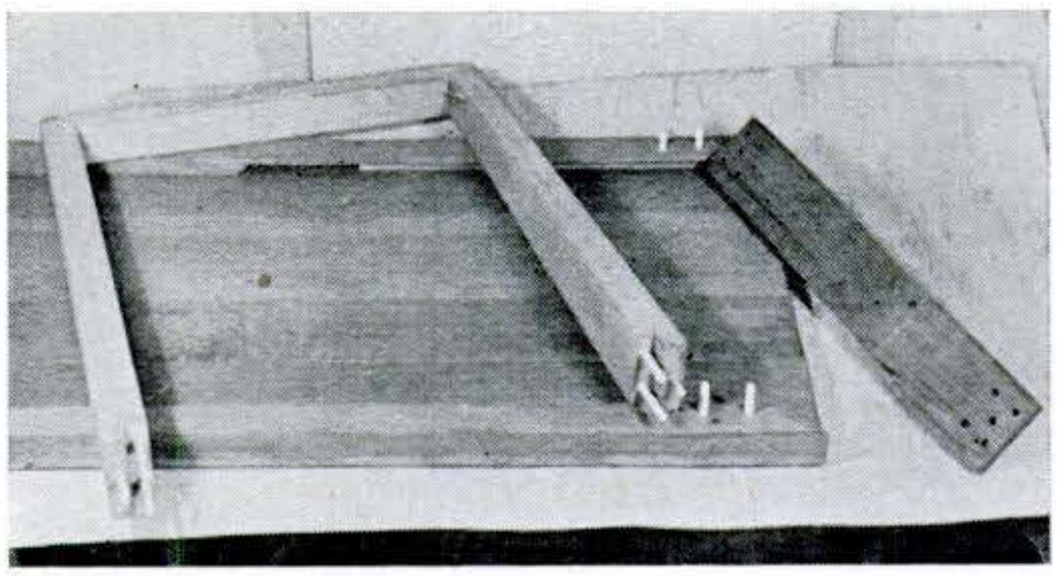


**Basic assembly** of pedestal is shown here. Panels are rabbeted into frame. Front stretchers are planed to same angle as drawer notches.



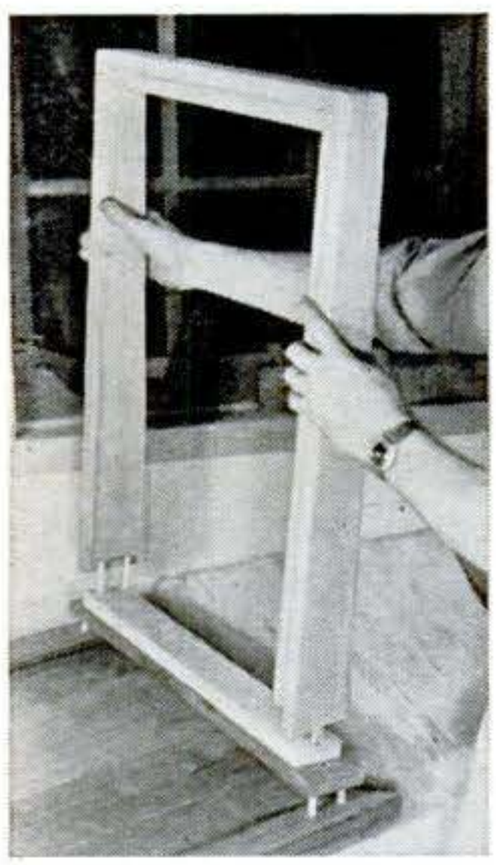
**Two stubby legs** under pedestal are cut from stock 3½" square. They are fitted with ½" dowels and glued into holes in pedestal floor.



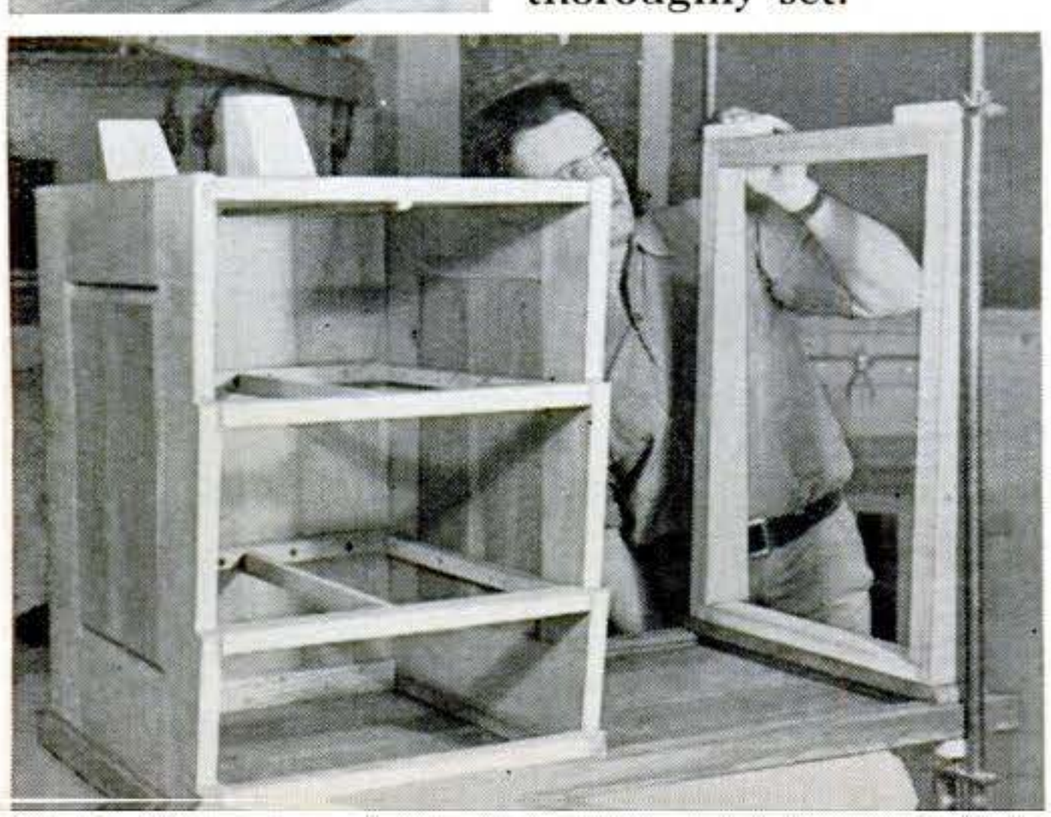
**End leg is a glued-up rectangle.** It's doweled to the top through the bridge shown at right. Mahogany bridge spans rabbets for sliding leaf.

the overlapping drawer fronts. These recesses are ⅞" deep at the top so each ¾" drawer front laps the one beneath by ⅛".

The back may be solid stock or ¾" plywood, splined into the sides and rabbeted for the bottom. A ¾" by 1" length of mahogany is doweled between the sides at the top front. Sides, back, bottom, and stretcher are assembled with glue, carefully squared, and clamped.



**Method of fastening** end leg, shown at left, insures it against wobble since it virtually becomes a single structure with the top.



**Pedestal** is in place. End leg is held tightly with pipe clamps until glue in doweled joints with bridge and top has thoroughly set.

The frames on which the drawers ride are hardwood with the front side of mahogany. After the frames are screwed to the pedestal, the center slides are glued in place. Front sides of the stretchers are planed off to the same angle as the drawer notches.

***End Leg.*** This unit is laminated from two thicknesses of ¾" mahogany with glue and dowels. It's attached to the top by a hardwood bridge that's doweled into the underside of the top.

***Drawers.*** They are similar in construction and the two lower ones are the same size. The sloping fronts come 1" below the bottom line to cover the separators and provide an unbroken appearance. Sides, back, and bottom are assembled with glue. This assembly is glued into rabbets in the front. Small brads may be used in the half-lap joints of the sides and back. Ends of the drawer fronts are rounded. Center guides are glued to the bottom and a finger recess mortised in the bottom edge of the front. No knobs are needed.

***Extension leaf.*** This is made the same as a breadboard, splined and glued together from widths of hardwood. The front crosspiece is walnut mitered at the ends to fit the top frame. Edges of the extension are rabbeted to slide along the rabbets in the frame. **END**



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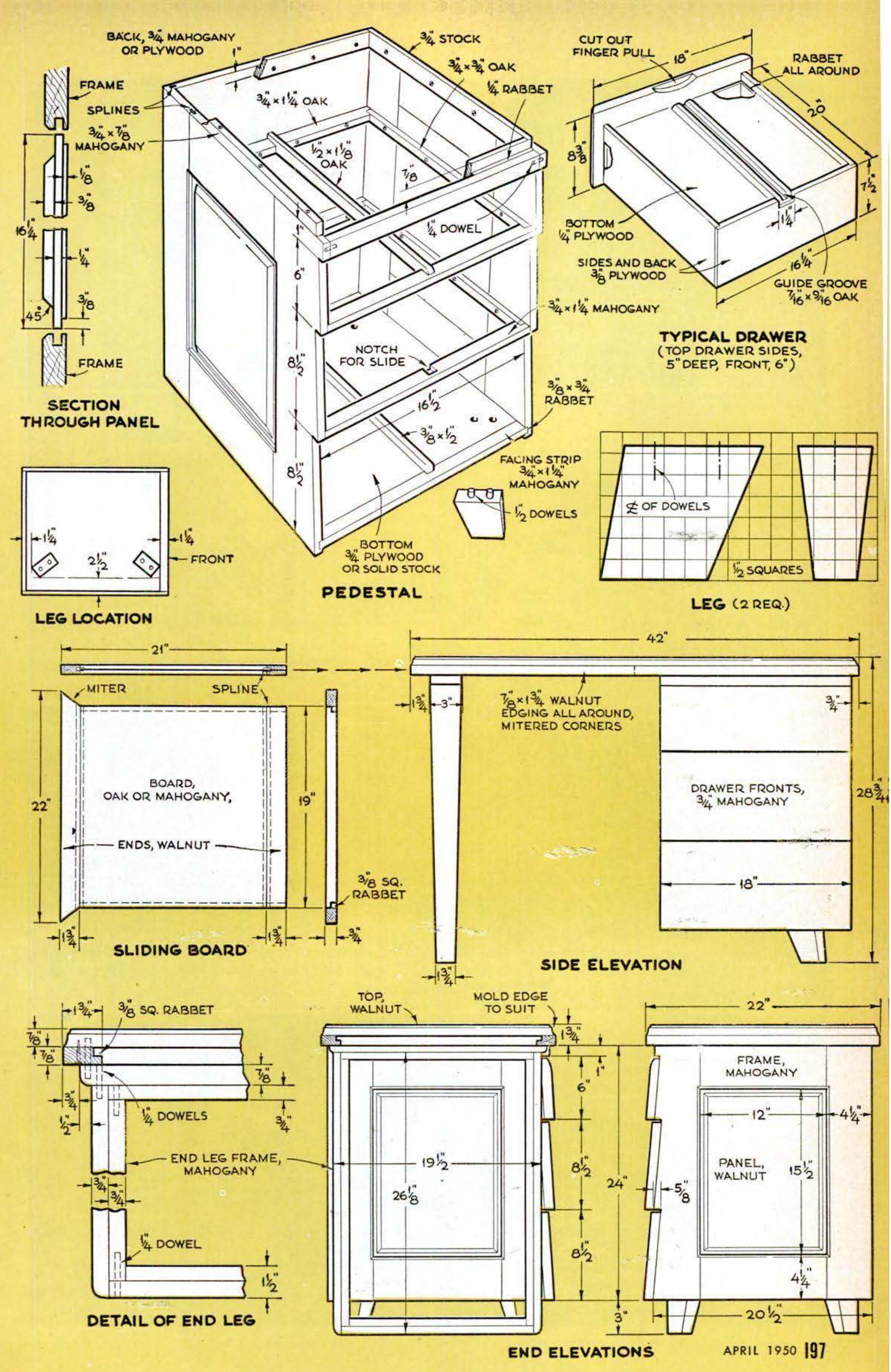




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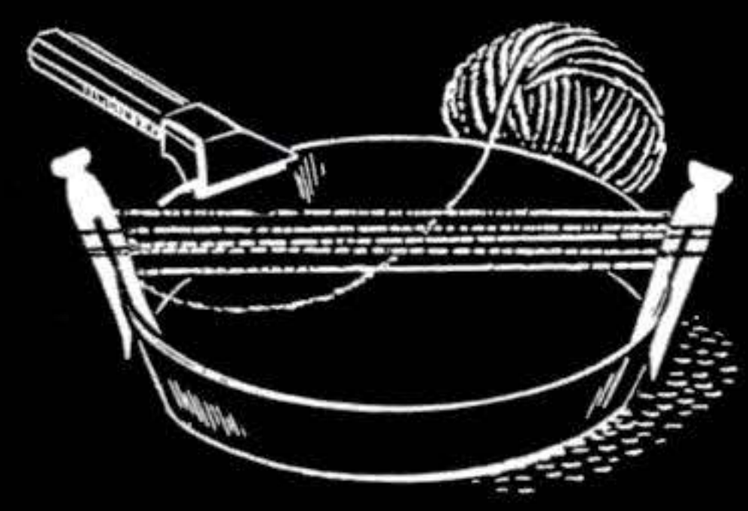
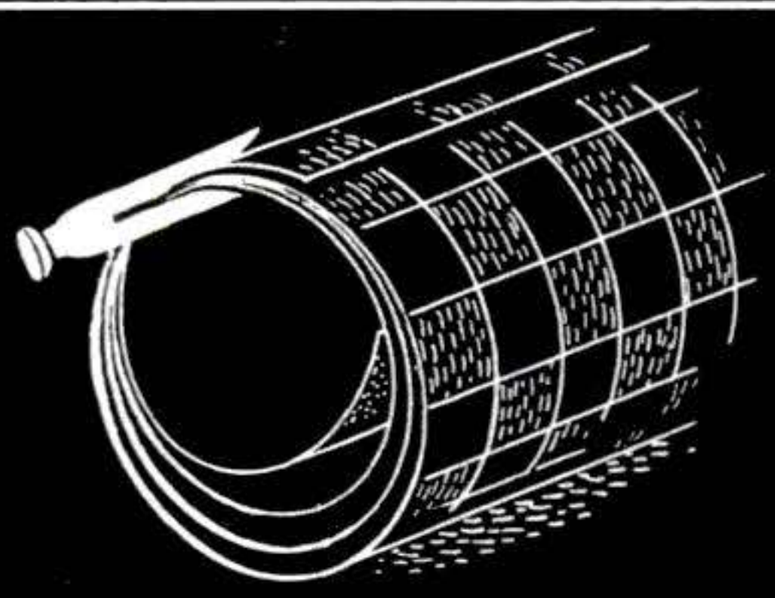
# Use a Clothespin

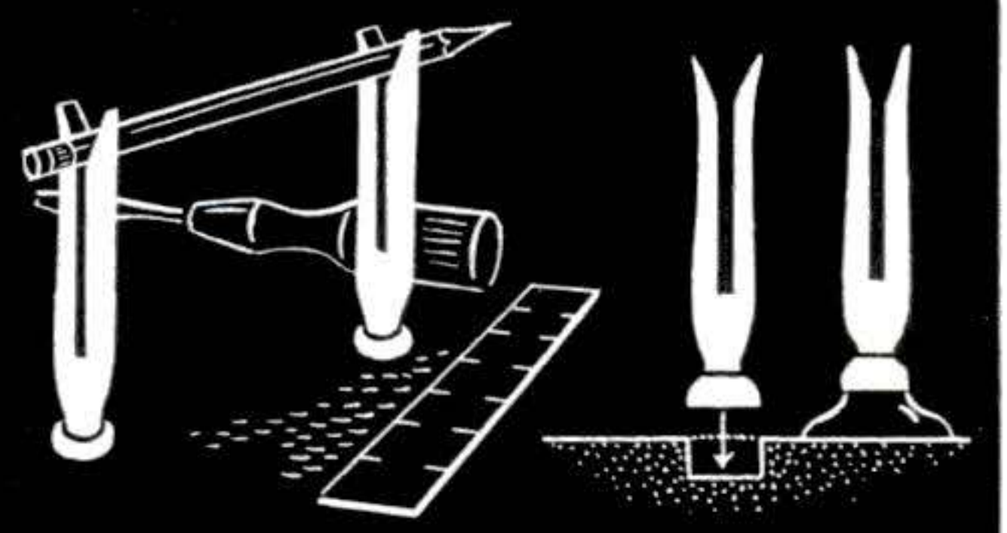
THE familiar two-pronged sticks that peg diapers to a clothesline can also be used for dozens of other chores. Why not keep a few in the workshop and kitchen as well as in the laundry? These drawings suggest a few of the ways in which they come in handy.



**They're a real help** in handling yarn and the like. Slip two pins over the edges of a pan and loop the yarn around them.

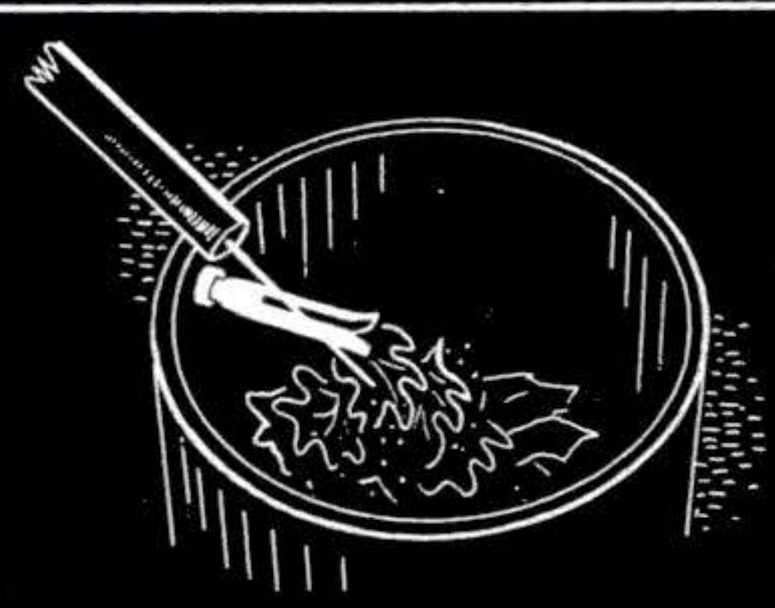


**Rolls of linoleum,** cardboard, and other hard-to-tame materials won't unroll when edges are clipped in with clothespins.

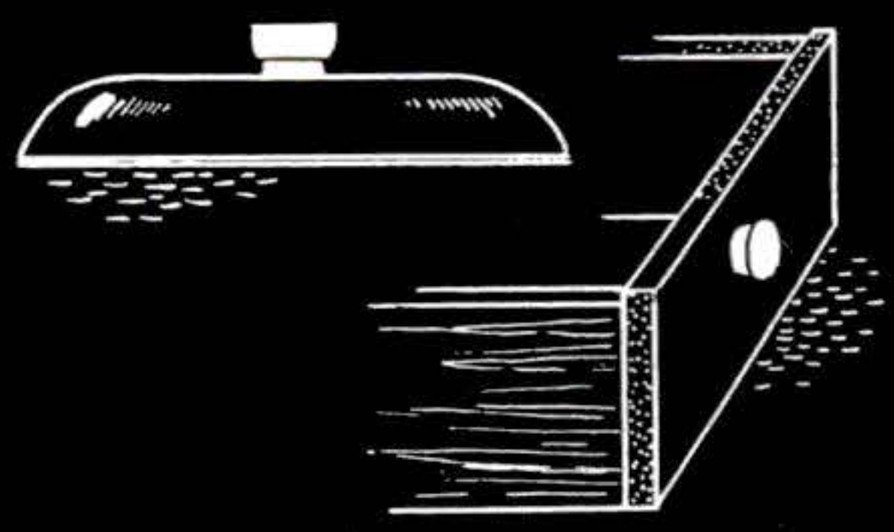


**Workbench pencils** can't get lost if they are pinned up. Attach pins with brads or suction cups, or set them into holes.

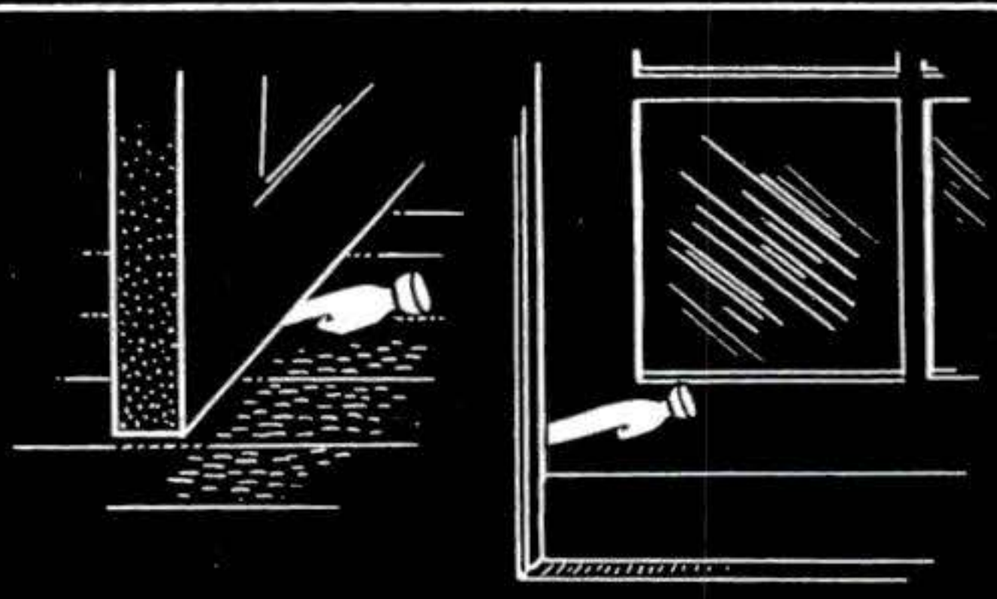
**Slipped over the hood** of a baby carriage, a clothespin will dangle baby's rattle or toy right where he can grab it.



**Gardeners** can simplify spring cleaning by fastening pins to trash baskets. The fork gets all rubbish off pickup stick.



**Small pot knobs** and drawer pulls can be made in a jiffy. Saw off part of a pin's head and screw it on from the inside.



**One-legged pins** are naturals as wedges and rattle stoppers. A broken pin forms its own wedging angle on any flat surface.



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# These Parts Put the World at Your Finger Tips

WOULD it be worth $2 to you to hear Europe, Africa, China, and other distant points on your radio?

That's all it costs to add a short-wave band to most postwar AC-DC receivers. And you can do it without affecting the normal working of the set in any way. There are no new tubes to buy and no complicated circuit changes. The only parts you need are a two-band switch, a condenser, and a couple of easily made coils.

First thing to determine is whether your set can be converted easily. It can if it uses the conventional AC-DC circuit employed in most small receivers built since 1942. These sets have a loop antenna and five tubes, one of which is a 6SA7, 12SA7, or 12BE6. The last is a 7-pin miniature used in very compact models.

Other tubes in the line-up are usually a 6SK7 or 12SK7, a 6SQ7 or 12SQ7, a 50L6, and a 35Z5. In the miniature line they will probably be 12BA6, 12AT6, 50B5, and 35W4. You may run into some variations in these tubes, depending chiefly on the date of the set. For example, the 6AV6 or 12AV6, the 35B5 or 35C5, and the 50C5 are alternatives in the miniature sets.



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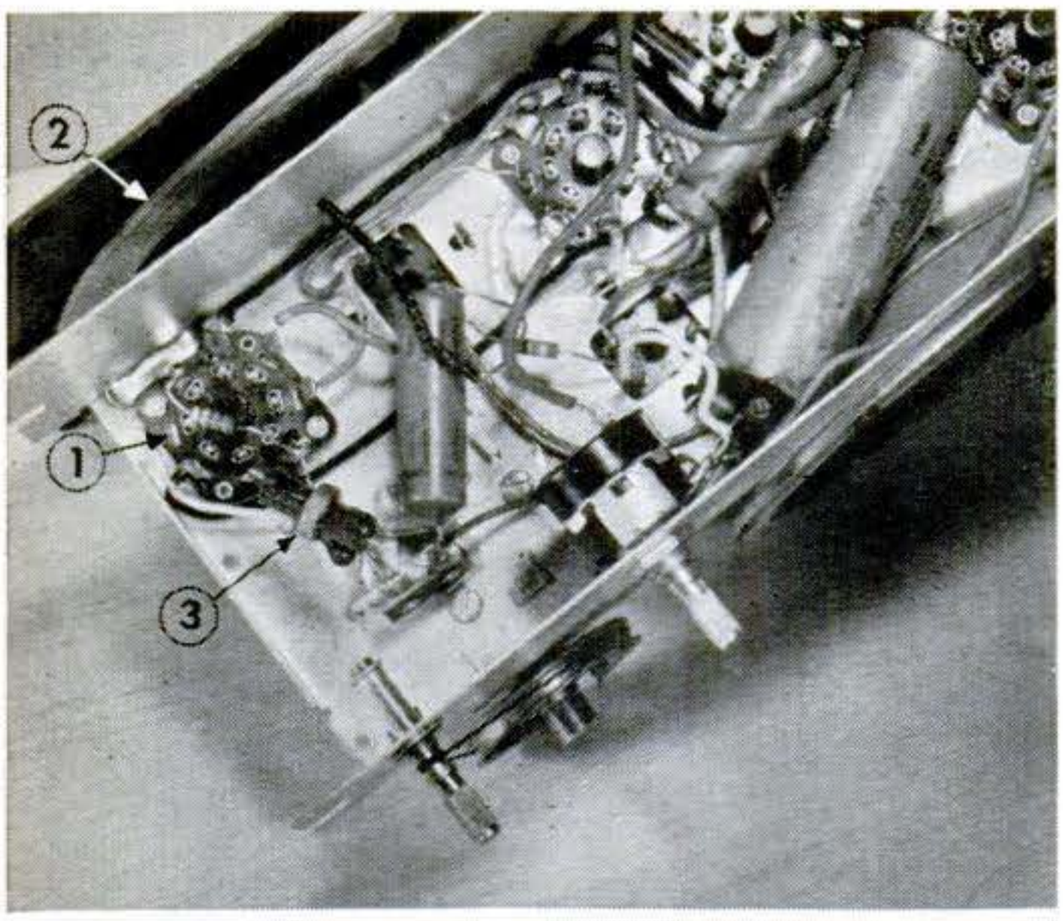
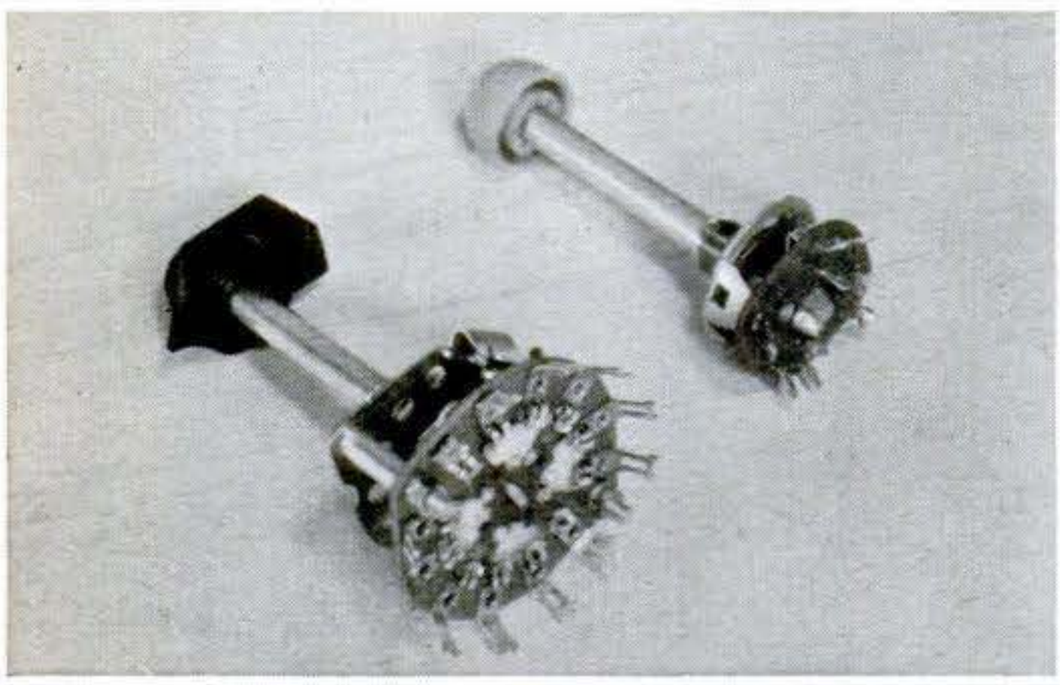
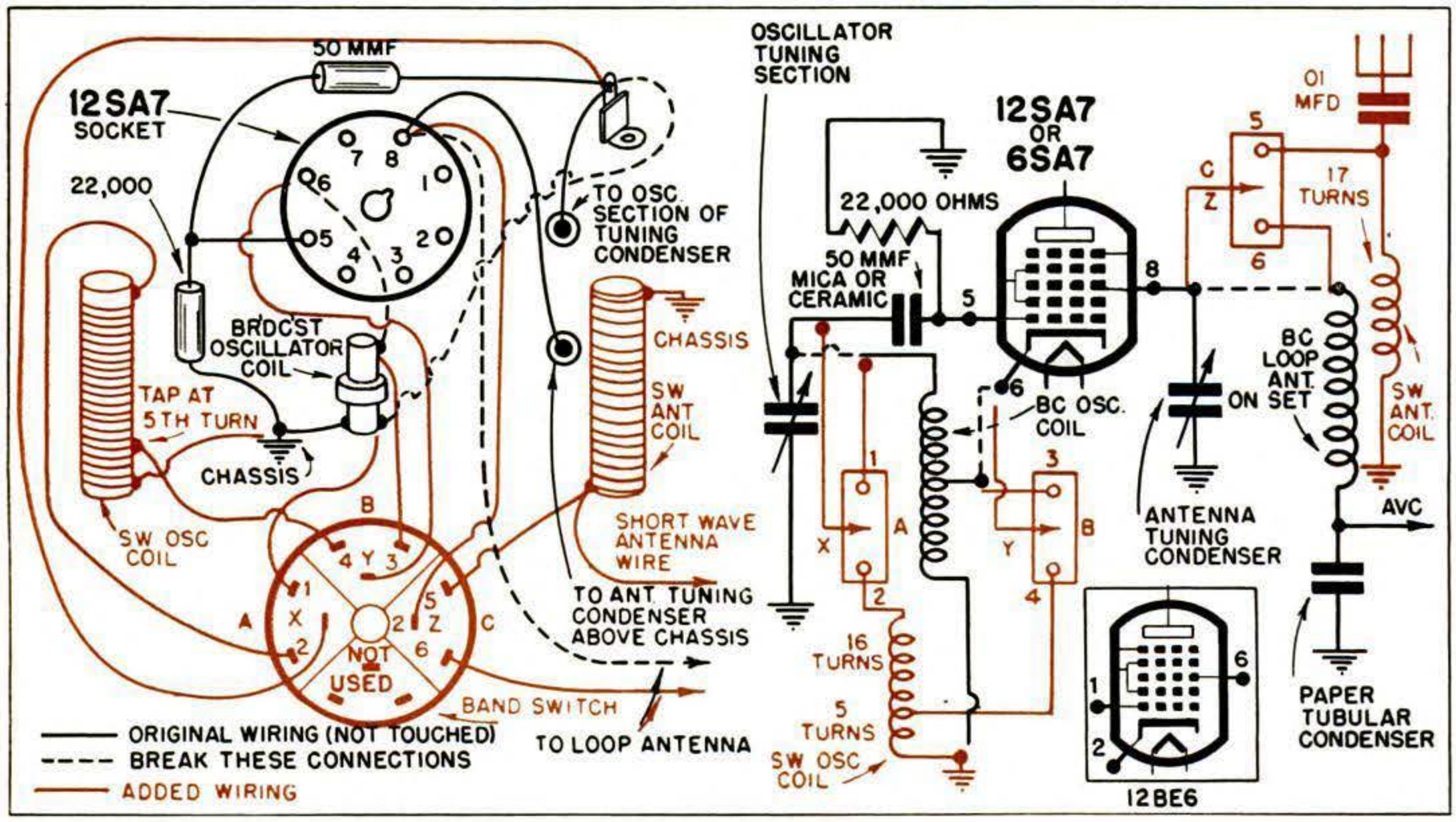



**Remove the radio** from the cabinet and locate the parts you will have to deal with. These are the oscillator-tube socket (1), loop antenna (2), oscillator coil (3), and the tuning condenser, which is on top of the chassis. The condenser has two sections, or gangs, and in most cases one will have larger plates than the other. The smaller gang tunes the oscillator section; the larger is the antenna-tuning condenser. Oscillator coils come in many different shapes so you may not recognize yours immediately. If you're in doubt, check the wiring. The coil has three wired terminals. One goes to ground (on some sets it's the chassis; on others a heavy bus wire is used as a floating ground). A second lug is connected to the oscillator-tuning condenser. The third is wired to the cathode of the oscillator-mixer tube (pin 6 on the 6SA7 or 12SA7, pin 2 on the 12BE6).



**Before you commence the wiring,** install the band switch. This is a 4-pole, double-throw unit. (Actually you need only three poles, but these are harder to get than the 4-pole type.) The conventional ones will be too large for most receivers, so shop around for the smallest switch you can find. The smaller one of the pair at left measures about 1¼" across the base. It is handy to bring the switch out the front of the chassis (which requires drilling a new hole in the cabinet), but if space doesn't allow, you can place the switch toward the side or back.




**When the switch is mounted** you're ready to start the wiring. One of these diagrams is pictorial, the other schematic, but both show the same things. Broken lines in both diagrams show connections that have to be removed. First cut or unsolder the wire that goes from the oscillator coil to the cathode terminal of the tube socket. Also break the connection between the coil and the oscillator-tuning condenser. The third lead that has to be cut goes from the loop antenna to grid No. 3 of the tube. The next step is to restore all these connections exactly as they were except that they now go through the switch. You should be able to plug the set in and play it the same as before if the switch is turned to the correct position.



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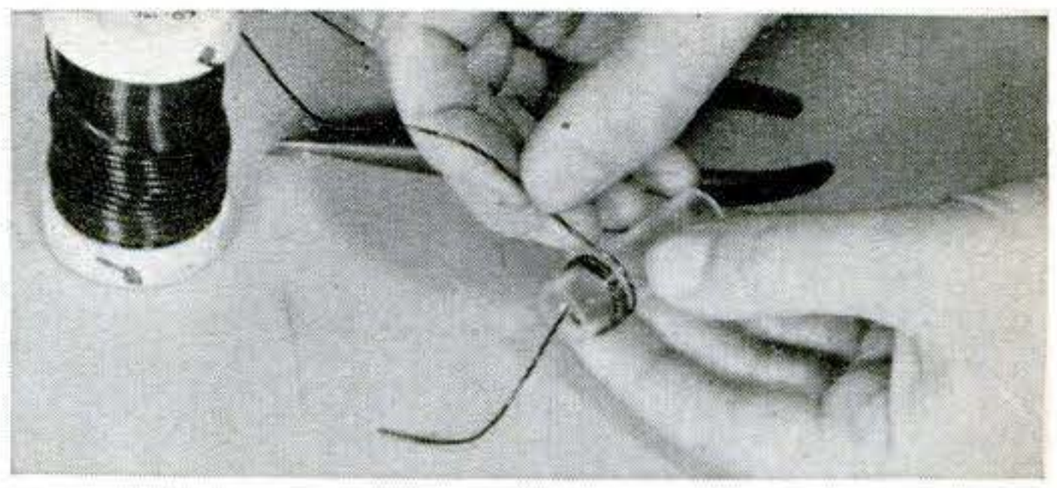
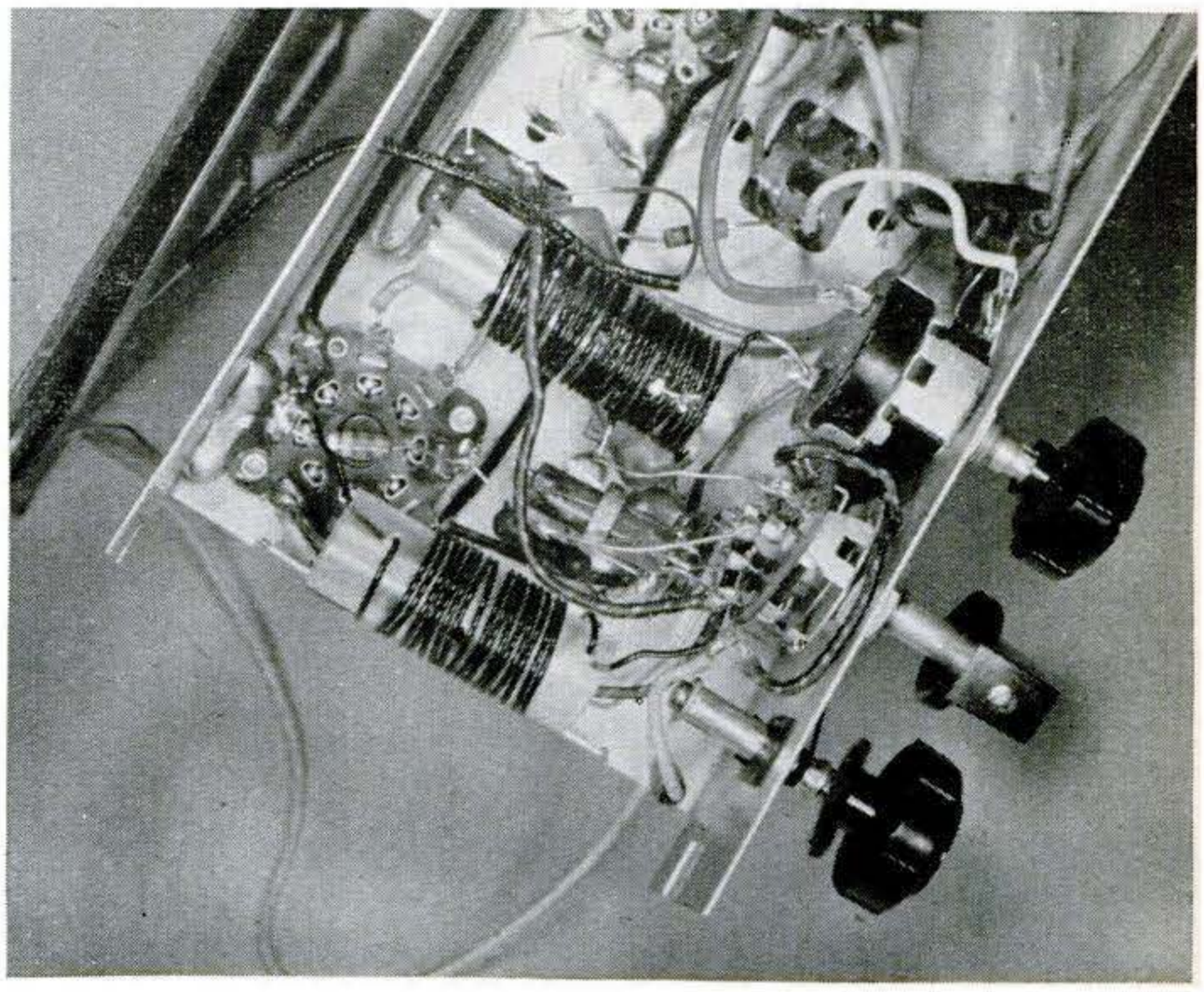
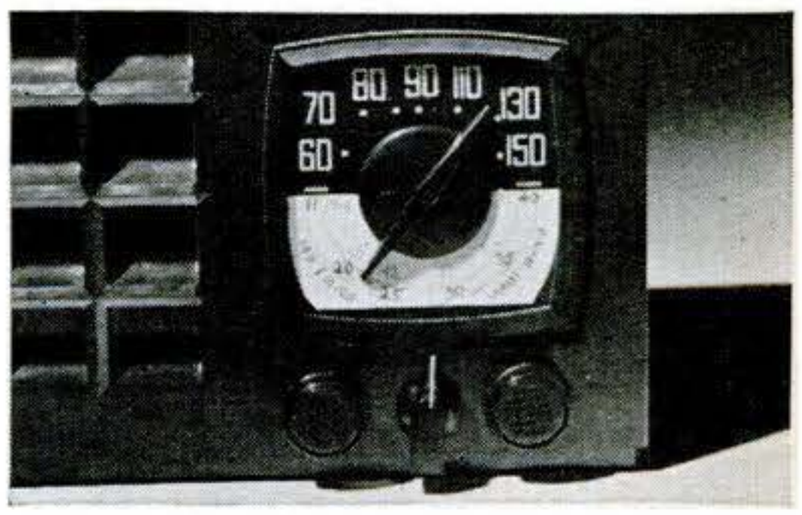
**Now start on the short-wave coils.** To make them you need a couple of inches of ⅝" plastic or similar tubing and some No. 18 enameled wire. Drill small holes through the tube walls to bring the wire ends through. For the antenna coil wind 17 turns on a 1½"- to 2"-length of tubing. The oscillator coil takes 21 turns on a similar length. At the fifth turn scrape a bare spot through the enamel and solder on a piece of wire as a tap.

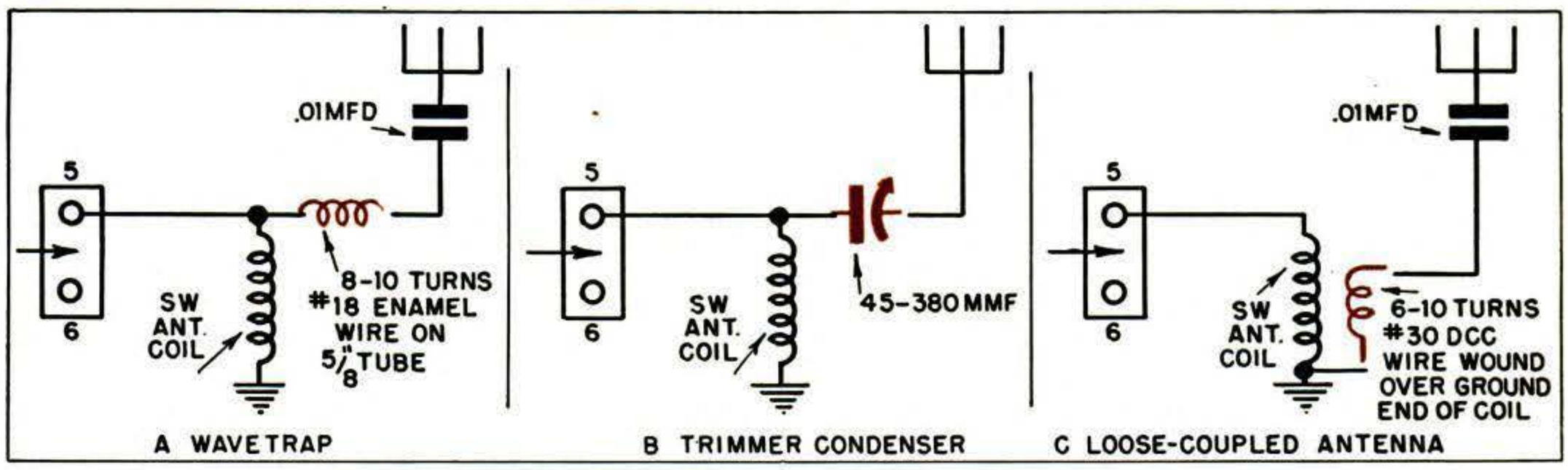


**Fit the coils in** under the chassis. They are light enough to be supported by their own wires. Ground one side of each coil. Either end will do on the antenna coil but on the oscillator it must be the one nearer the tap. Connect the remaining terminals to the switch as in the diagrams. In one switch position you have regular broadcast reception; in the other, short-wave. Connect a 25′ hank of wire for a short-wave antenna, inserting a protective .01-mfd. paper condenser in series with it.



**Here's the front panel** of the finished set, now a two-band receiver. Often only half the dial is used for broadcast-band calibration, so you can use the other half for short-wave markings. In this case a piece of cardboard was pasted over the lower half of the dial and calibrated in both meters and megacycles. A signal generator could be used for scale marking, or you can listen for station and frequency identification. The set covers 17 to 40 meters.




**If you live very close** to a regular broadcast transmitter, you may be troubled by "breakthrough," that is, hearing the nearby station on your short-wave receiver. If so, you can increase selectivity by the methods above. Shielding the coils may also help. Slip the cardboard sleeve from a flashlight cell over a coil and wrap tin foil around it. Solder a ground connection to the foil, and then wrap it with insulating tape to prevent accidental shorts.



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# Jigsawed Lamps Dress Up Nursery

***By Karl Greif***

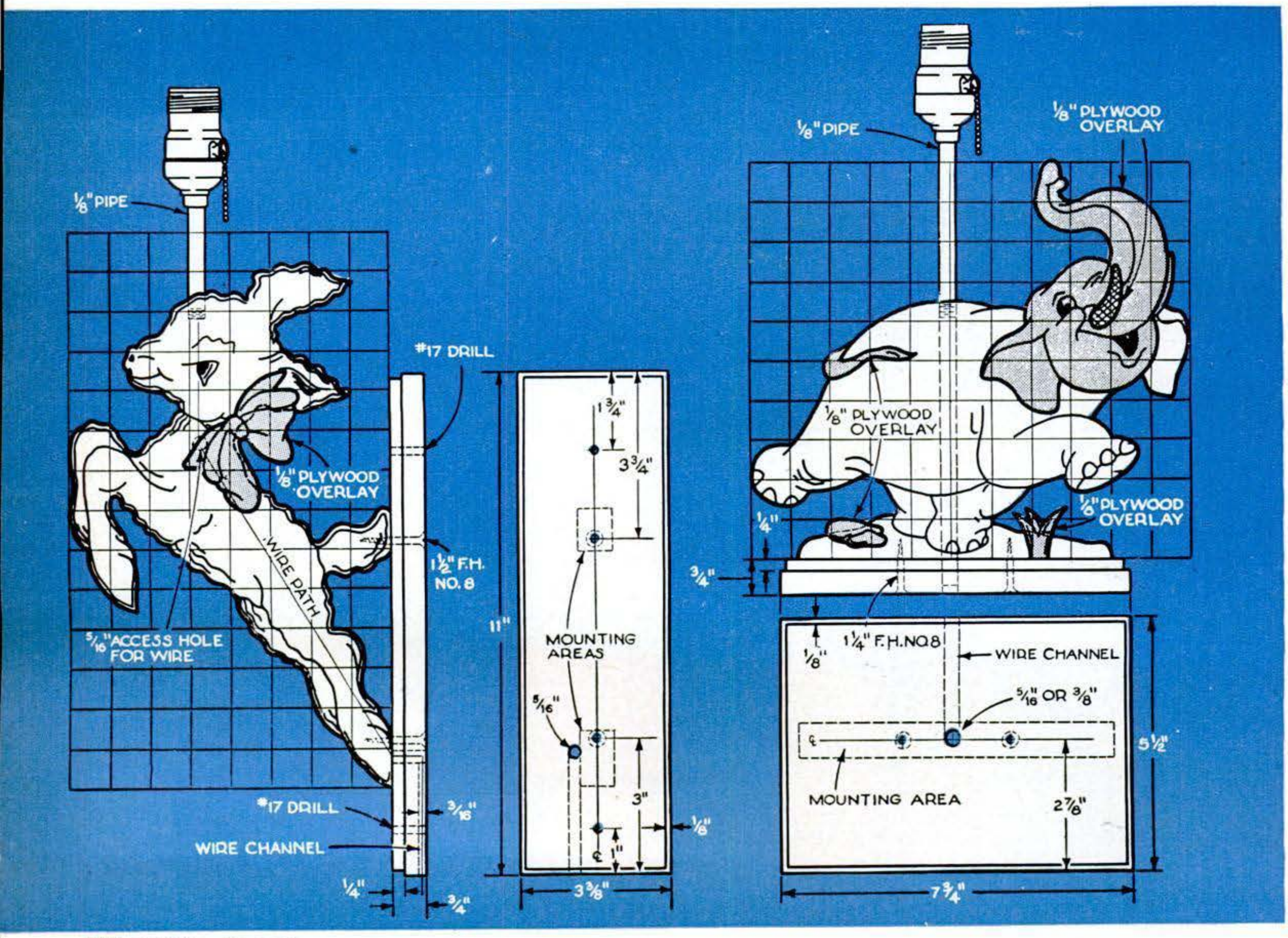
CHILDREN are sure to like these cheerful animal lamps. Besides adding a bright note to your child's room, they're built to take the rough handling a youngster may give them.

The lamb can be securely screwed to the wall into a stud rather than mounted like the usual pin-up lamp. You'll find this much more satisfactory. Even if your child yanks on the pull chain, the lamp won't come down. Pull-chain sockets are used because they are easier for a child to operate than the button types. And then, too, with the chain, there's not so much chance of a youngster accidently touching a hot bulb.

As you'll notice in the drawings below, some of the areas on both figures are shaded. These are overlays of ⅛″ plywood, glued and tacked to the base pieces. The base pieces are cut from 1″ stock, preferably hardwood.

***Lamb***—After you've jigsawed the figure, cut out the bow and attach it. Drill the wiring hole down as far as the bow. Drill another hole from the back of the lamb to meet the vertical hole. The lamp cord runs down the back of the figure through this hole as indicated and into a hole in the mounting board.

***Elephant***—Cut out only the part of the plywood head that overlaps the body. Then fasten this part to the 1″ stock. Cut out the rest of the figure by sawing through both the overlay and the 1″ stock at the same time. That way you'll get perfect matching of these edges. The plywood tusk is cut out separately and glued on.



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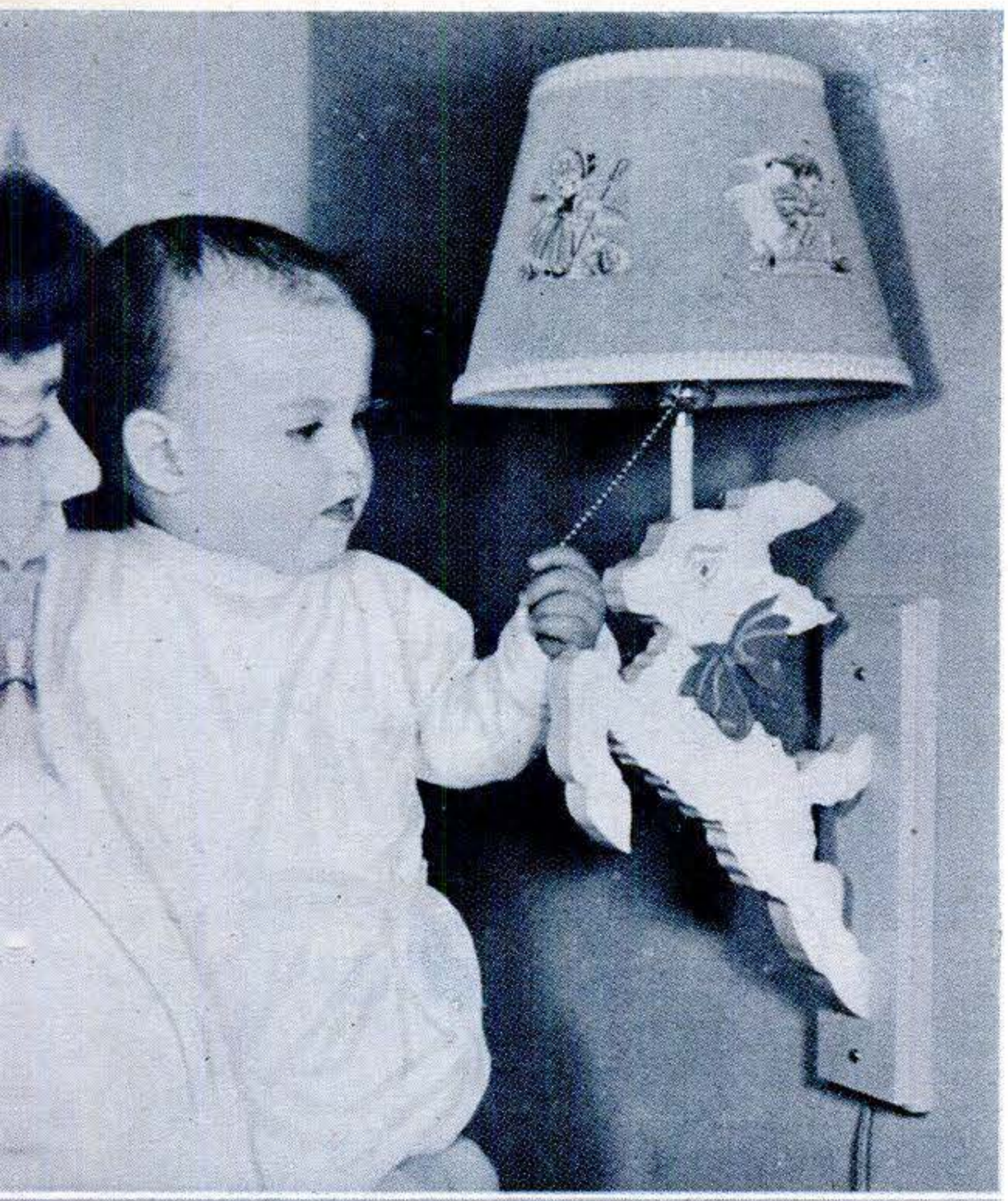
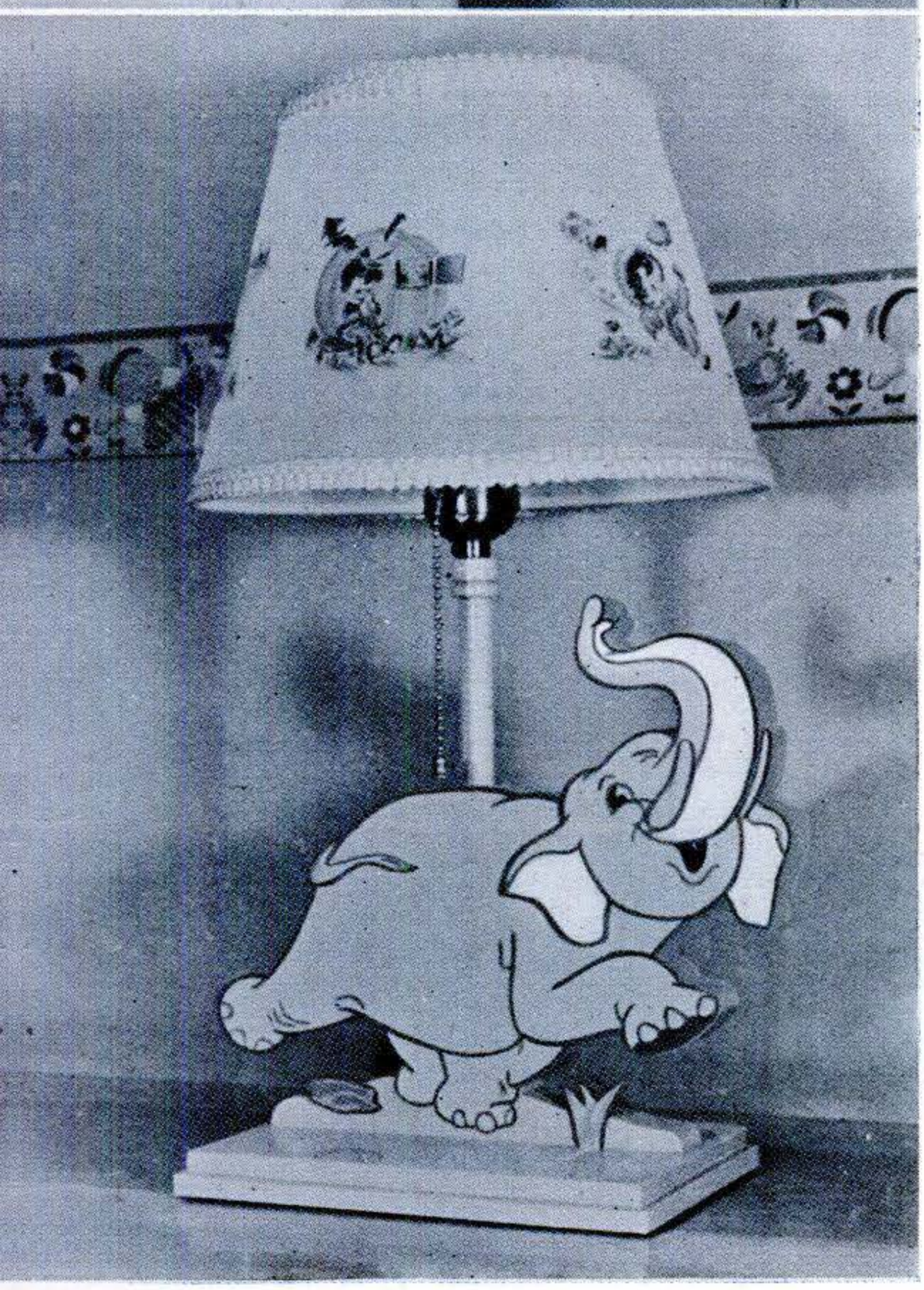
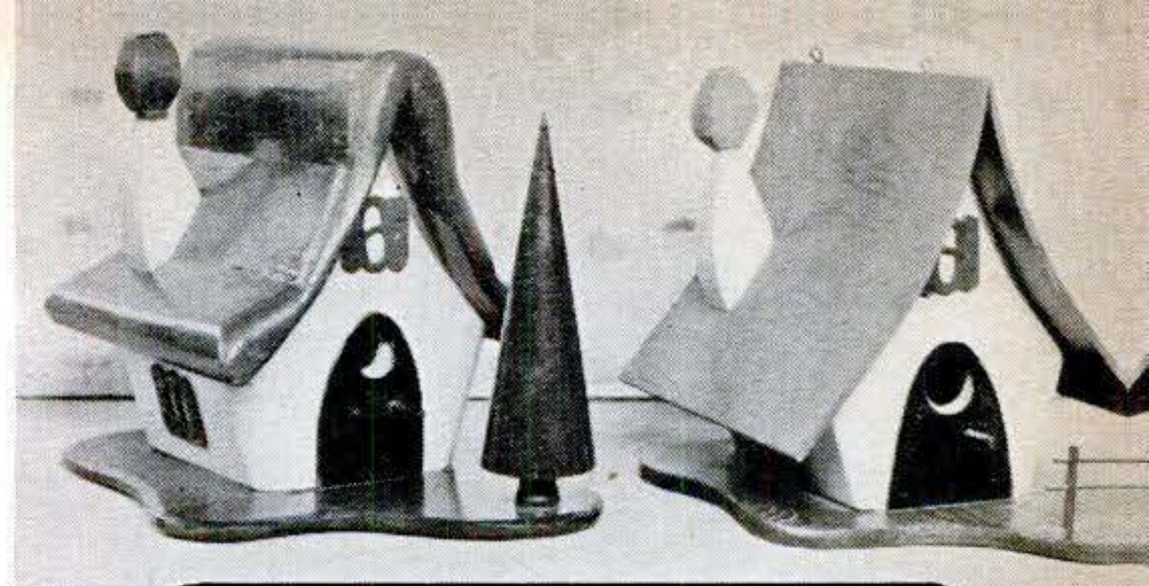






# CRAFTSMEN AT WORK

KARL GREIF, designer of the nursery lamps at the left, told POPULAR SCIENCE readers how to build the "Storybook Birdhouse" (pictured at the left above) in March, 1948.

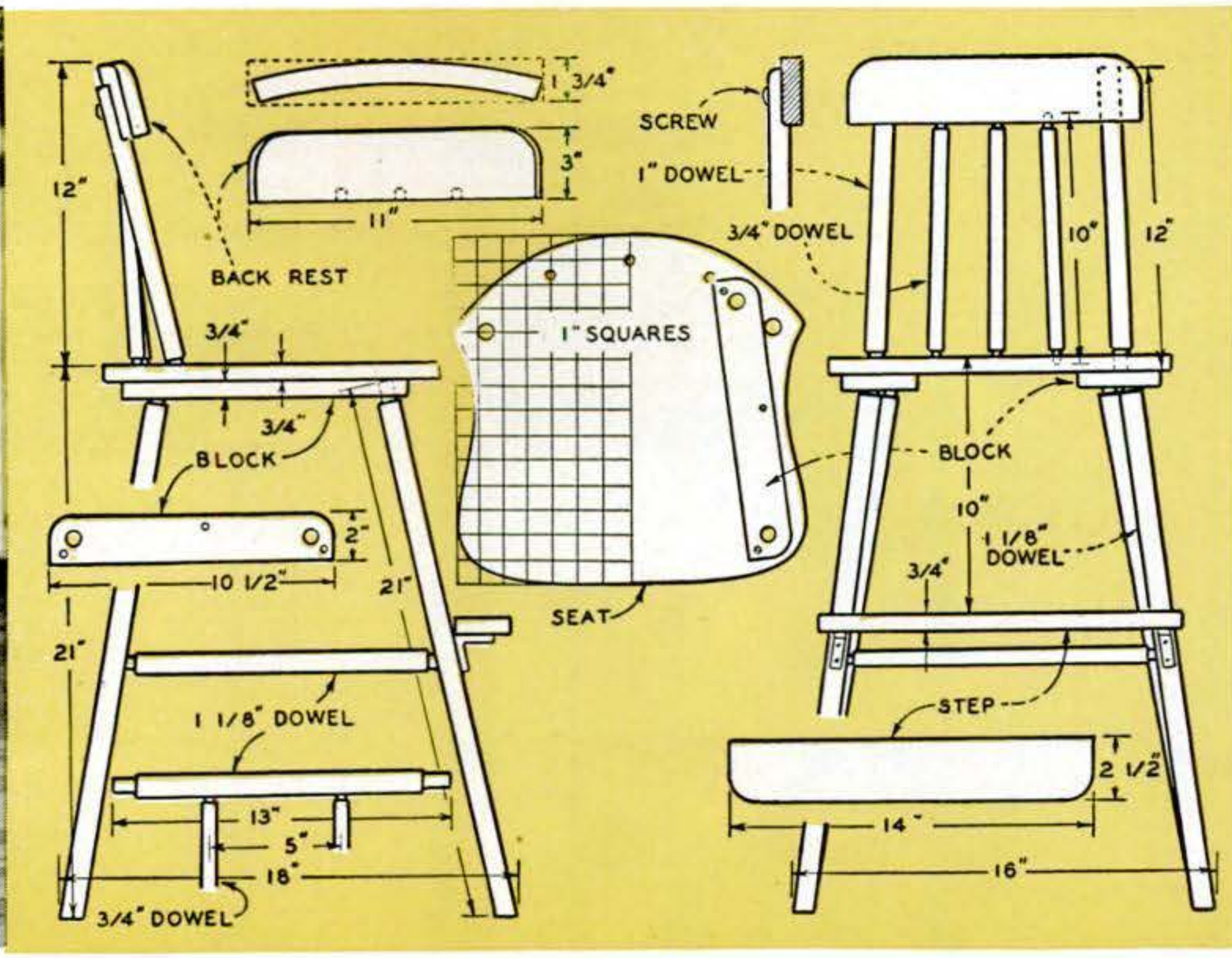
Dave and John Tuttle substituted a rail fence for the cone-shaped tree and a curved plywood roof for the thicker one. Result: the house at right above.

That put them in business. They took their first house to a Portland, Ore., department store. The store wanted more. Bird lovers liked the houses and soon other stores across the country were marketing the Tuttle product.

The brothers began production with only a handful of tools. Today they operate a complete woodworking shop and have enlarged their line to include several other birdhouses, feeders, and nesting stations. But the Storybook Birdhouse still outsells all the others.

**Double garage** at Tuttles' home has become a birdhouse factory. Above, the two brothers and their helper assemble the houses.

**PS-inspired** birdhouses move out of Tuttles' shop by the score. The houses are completely assembled with nails and waterproof glue.



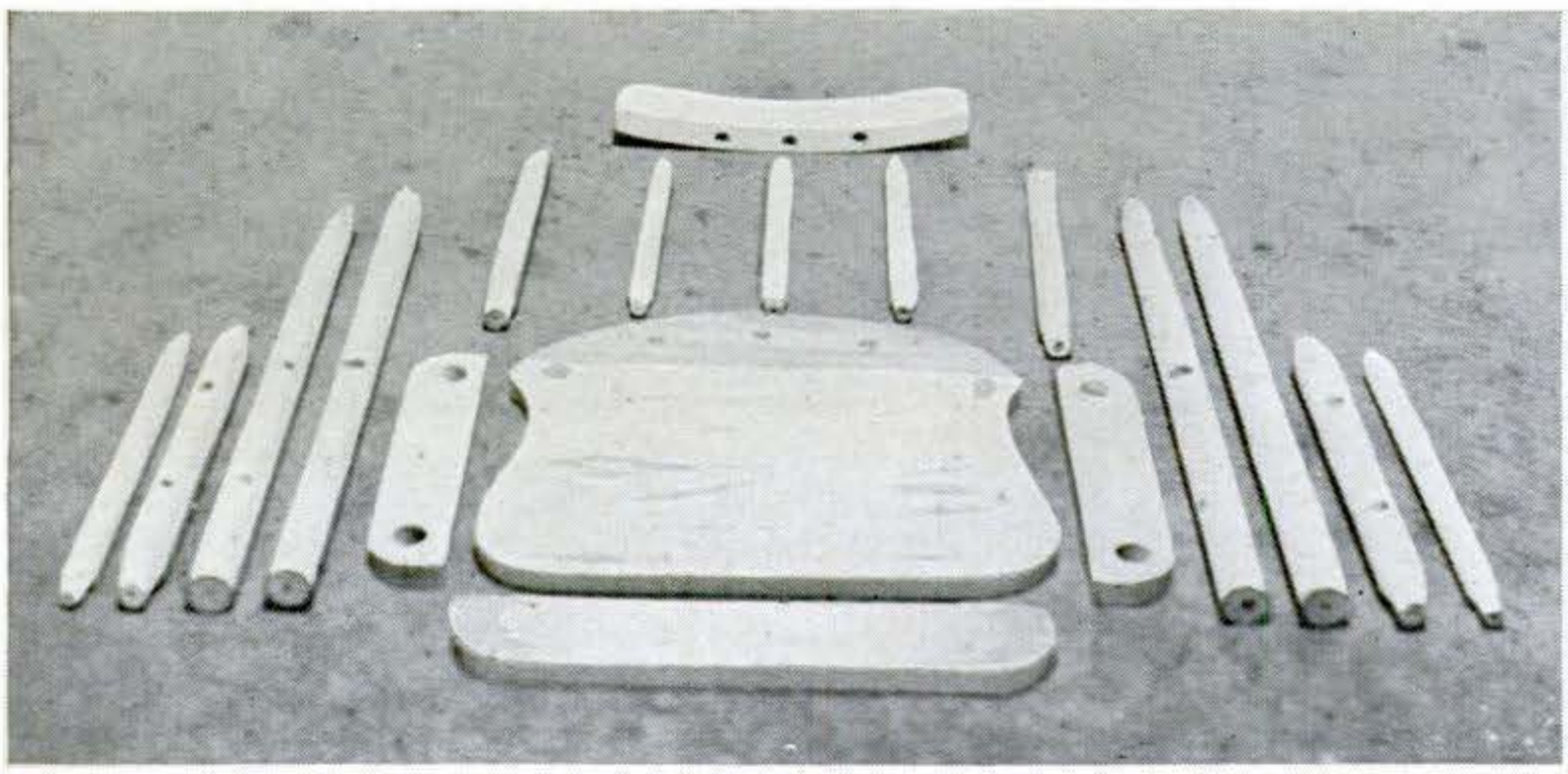

# $3 Chair Fits Growing Child

WHEN a youngster gets too big for his high chair but still finds a dining-room chair too low, he needs a chair like this. It's easy to build—the materials cost only about $3—and the seat can be lowered by sawing off the legs as the child grows.

To build it, you'll need:

- Four lengths of 1⅛" dowel stock, one of 1" dowel, and two of ¾" dowel for the legs, back spindles, and stretchers. You can usually buy the dowels in 3' lengths at a lumber yard.
- A 14" by 14" square of ¾" stock or plywood for the seat.
- A block 1¾" by 3" by 11" for the back rest.
- Two ¾" by 2" by 10½" pieces for the seat braces.
- A ¾" by 2½" by 14" piece for the step, and two 1½" angle brackets.

After shaping the seat and back rest, bore ¾" holes in the seat for the 1" side spindles that support the back rest. Bore ⅝" holes for the ¾" spindles, and turn down the ends of the dowels to suit. Glue and screw the blocks under the seat. Bore ⅞" holes in these for the legs. Then attach the step 10" below the seat.—*Harold Jackson, Kankakee, Ill.*



**Cut and fit all parts** carefully before applying glue. Then assemble and glue together the legs, rails, and seat. When the glue has set, assemble the back and glue it in place. Use clamps or drive small brads into all glued joints. Finish with paint or stain as desired.



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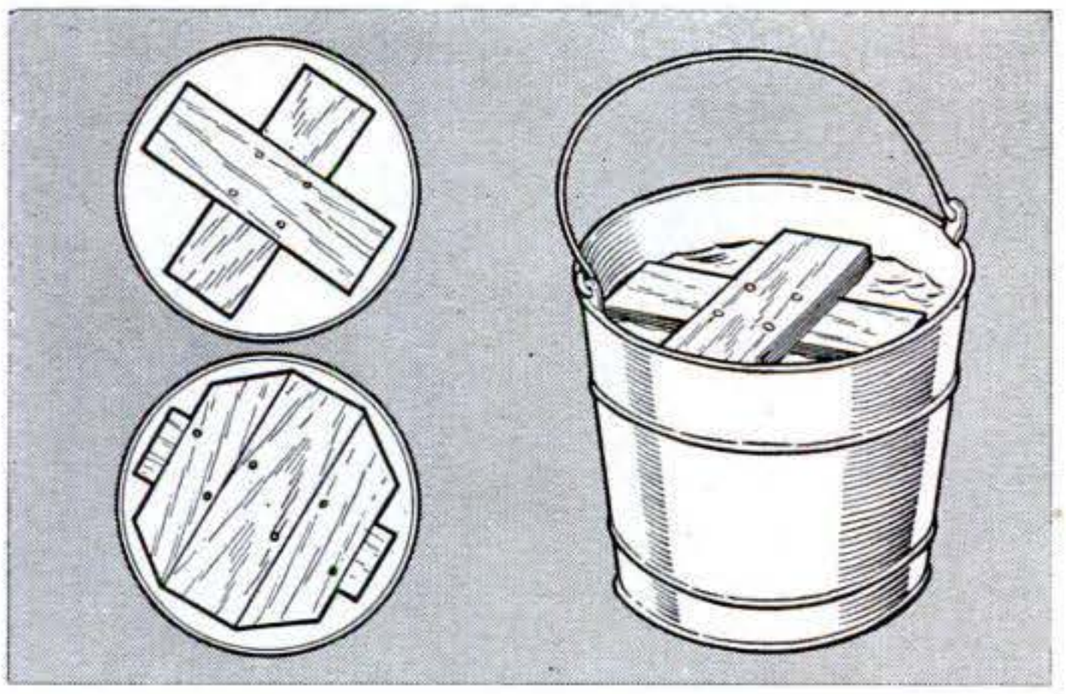
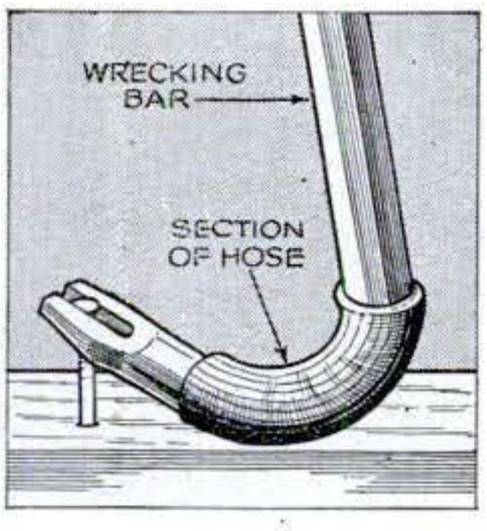
## Floating Lid Stops Slopping



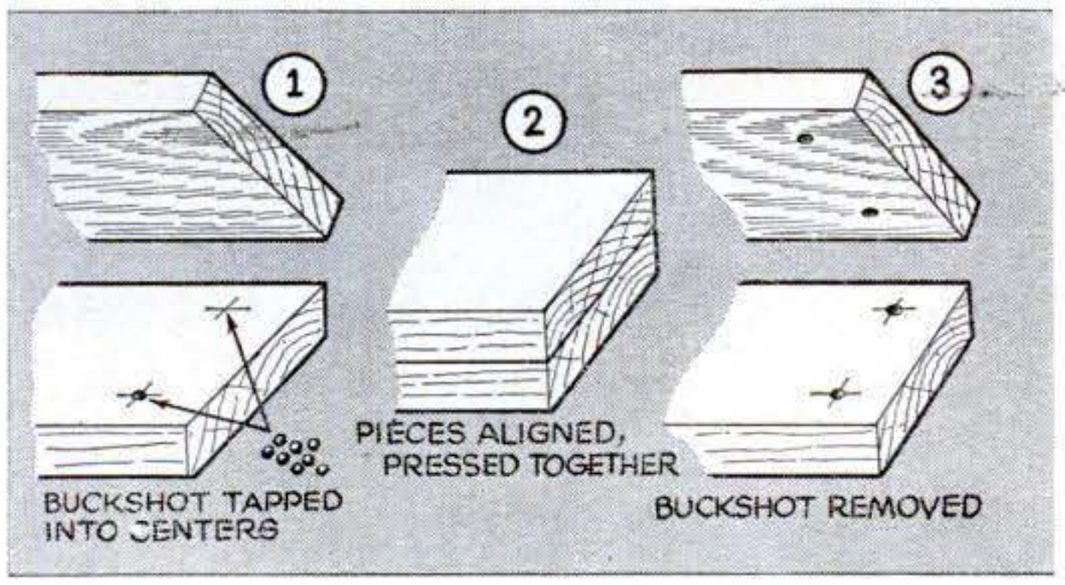
CARRYING water in well-filled open pails without splashing it on your feet is difficult, especially if you handle two pails on a frame across your shoulders. To prevent spilling, I float wood lids on the water as shown. You'll be astonished how well this little trick works. —*Wolfgang Wagner, Marburg, Germany.*

## Rubber Hose Prevents Marring

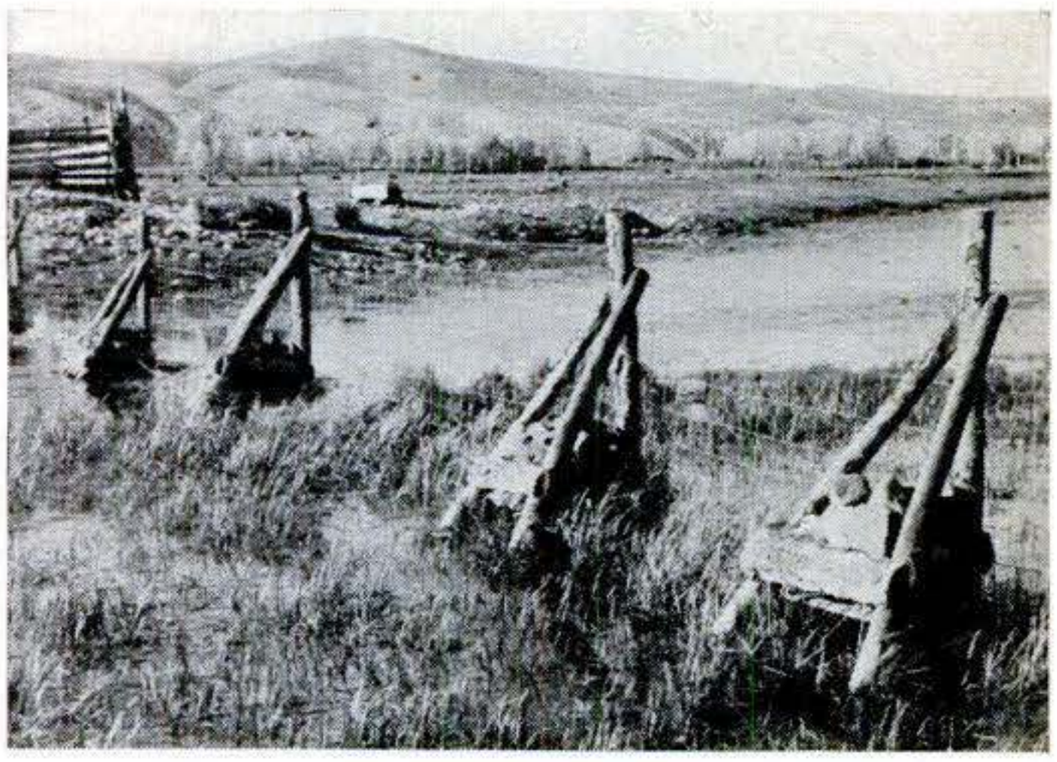



WHEN removing nails from wood that you wish to re-use, slip a short piece of rubber hose over the bend of your wrecking bar. This will largely prevent the bar from marring the wood where it bears on it as a fulcrum. —*James D. McCorkindale, Ames, Iowa.*

## Buckshot Aligns Blind Holes




WHEN blind holes must be exactly aligned in two pieces of wood, you can do the trick with some buckshot. On one piece, put a buckshot pellet at the center point of each proposed hole. Tap the buckshot into the wood for half its diameter with a small hammer (1). Then align the second piece of wood with the first (2) and clamp them together in a vise. Separate them, remove the buckshot (3), and the centers will be exactly aligned.—*Jo Ro Jung, New Orleans.*



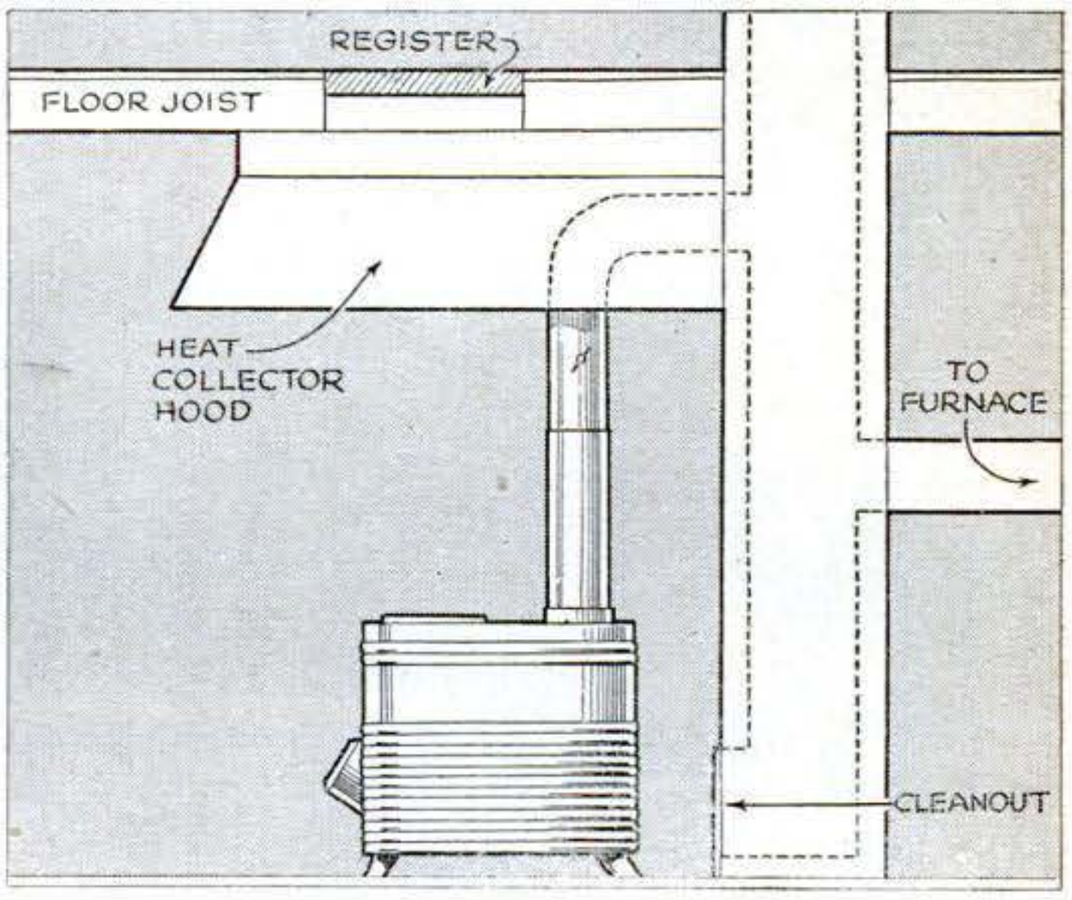
## Stone Baskets Hold Fence

ONE farmer eliminated trouble with a fence on swampy ground by constructing "basket" posts. Now fluctuation of the water level from season to season no longer lifts posts out of the ground. The regular fence was built in dry weather. Additional posts were set at an angle and bolted at the tops to the upright posts. Slabs and boards were used to make boxes to hold a heavy load of stones. The weight holds the fence in place during high-water periods.

## Saves Fuel Spring and Fall

ALTHOUGH an automatic furnace is a convenience, there's usually a period during the spring and fall when it runs too much for the little heat required, wasting fuel.

To lick this problem, I installed a small wood burner as shown in the drawing. In my home this is located under the kitchen. The hood and floor register keep the downstairs rooms comfortably warm on damp or chilly days. By closing the cutoff in the register, I can use the stove during the summer to burn household trash.—*L. E. Fay, Jr., Jefferson, Iowa.*



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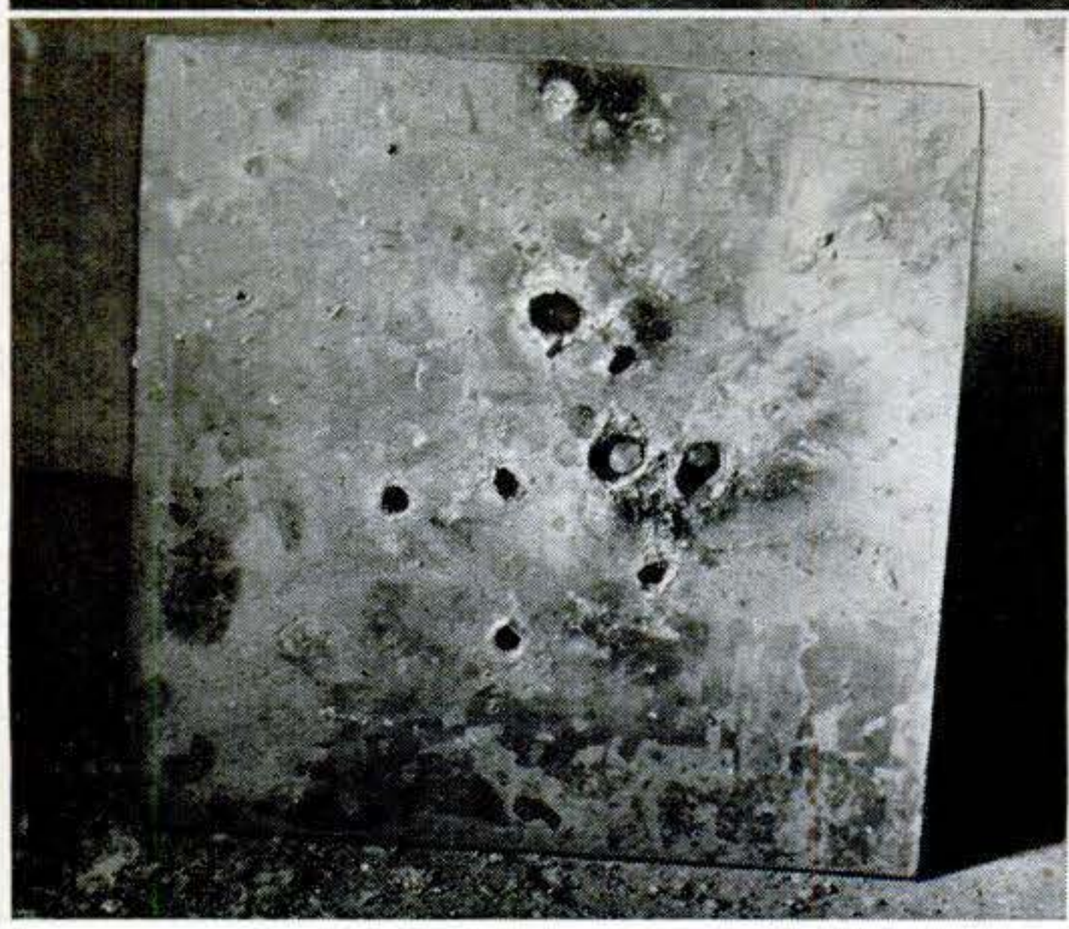
# Jacketed Electrode



**Heat and arc blast** pierce this steel plate, 1″ thick, in a trifle over two seconds. Arc is struck by a hard down thrust. Small holes (left) are made by fast feed; slow feed gives larger ones.

***PS photos by W. W. Morris***

CHALLENGING the dramatic surgery of the oxyacetylene torch, electricity now cuts metal cleanly and swiftly. A metal-rod electrode jacketed with a heat-resistant coating slices through steel like a hot lance through wax. Even cast iron, aluminum, bronze, stainless steel, and laminated stock—difficult to flame-cut—part before it without splatter, heavy slag formation, or weld-fasts.



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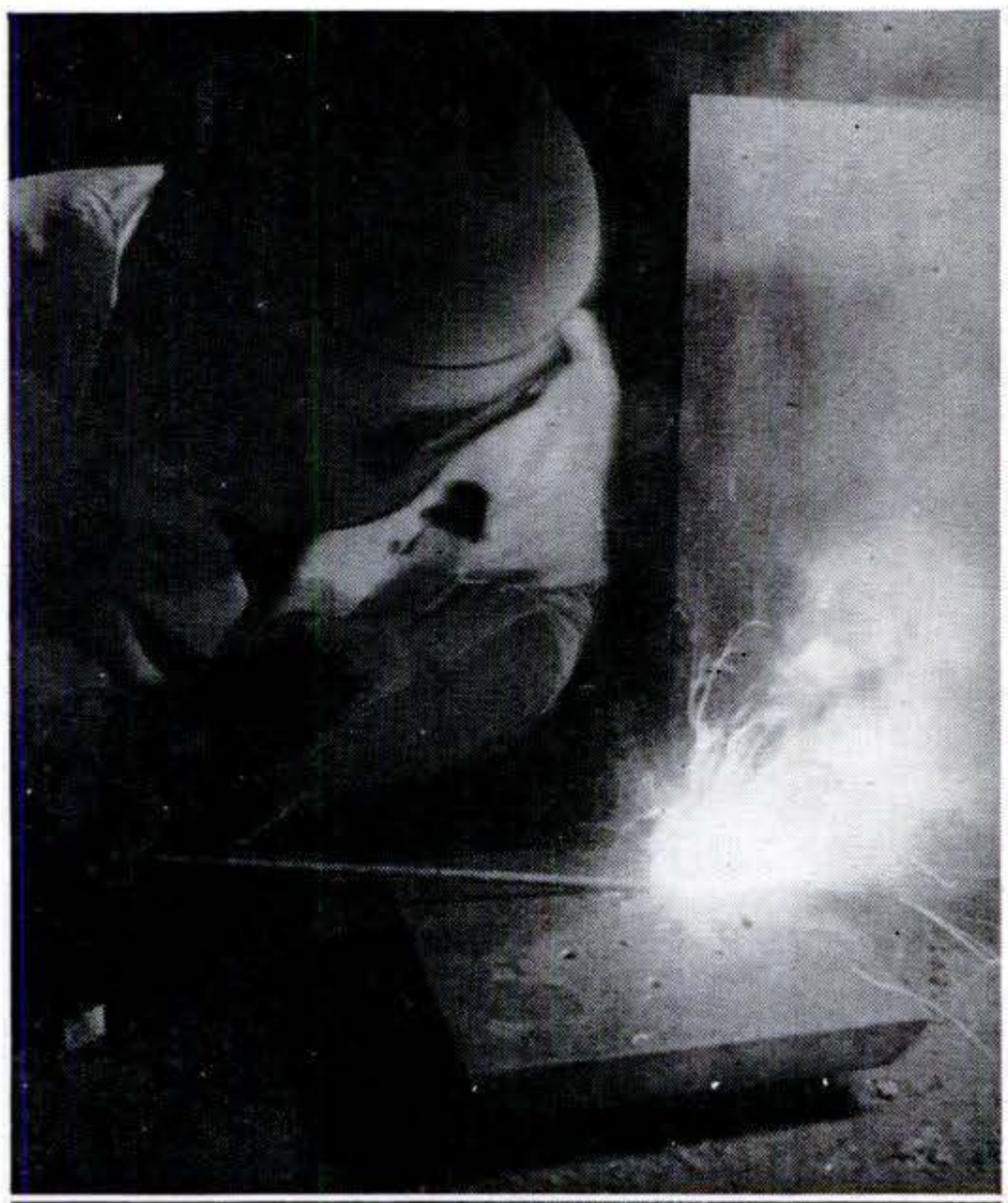
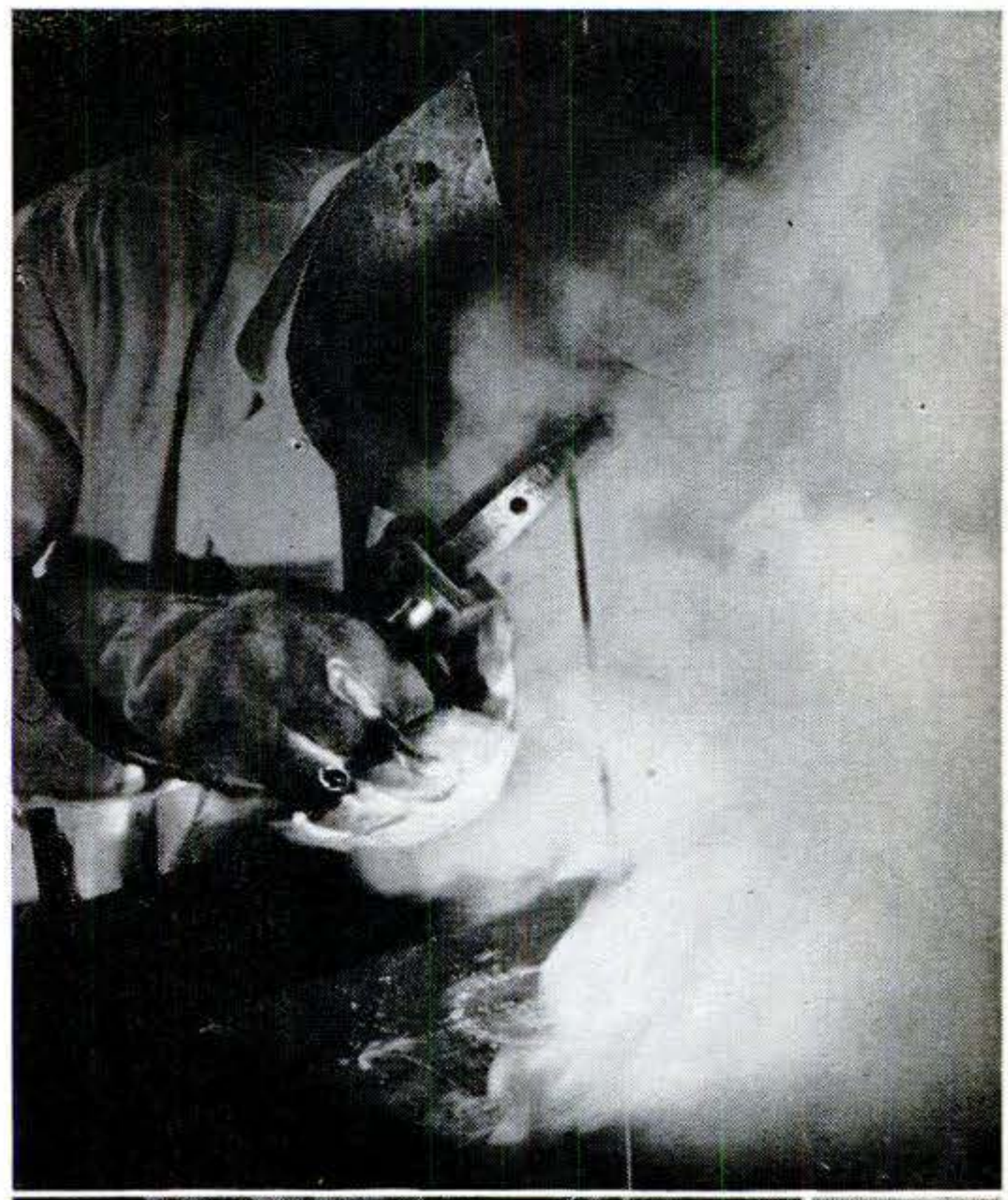
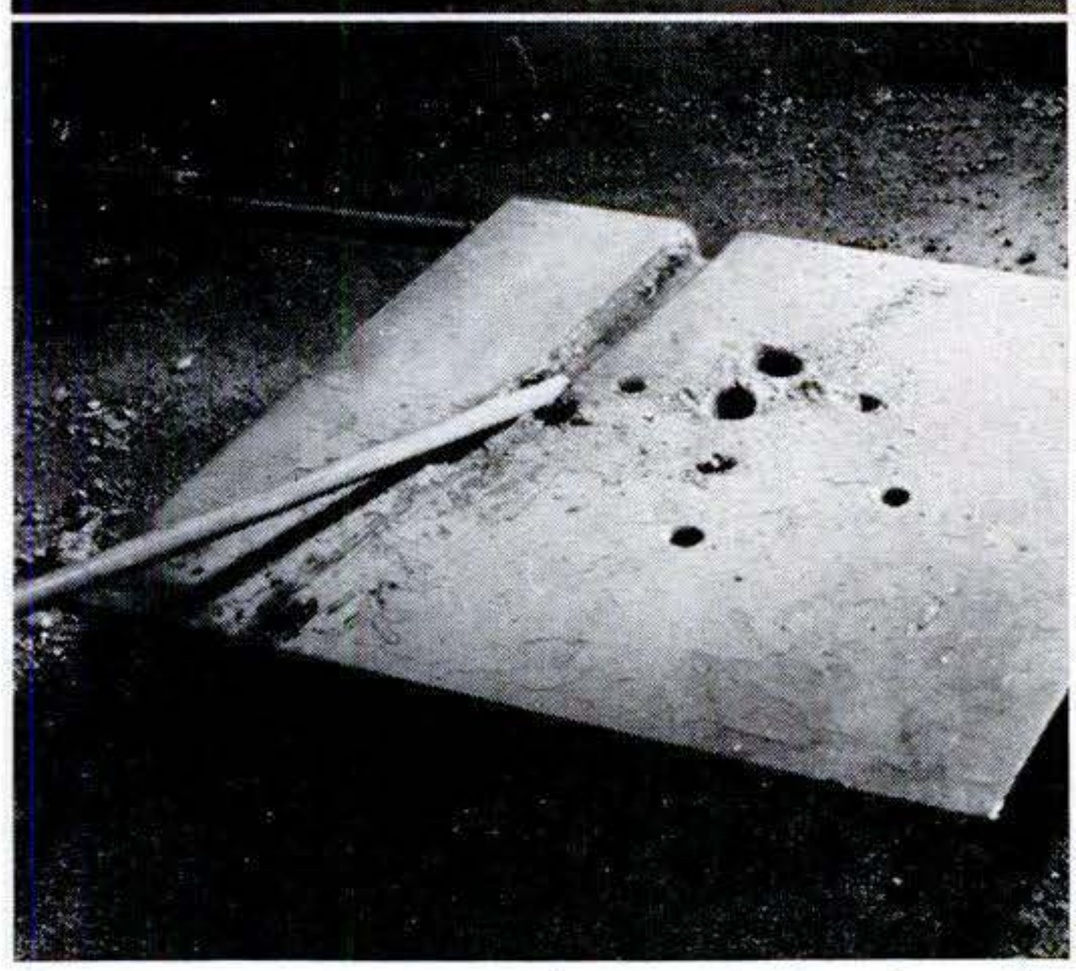
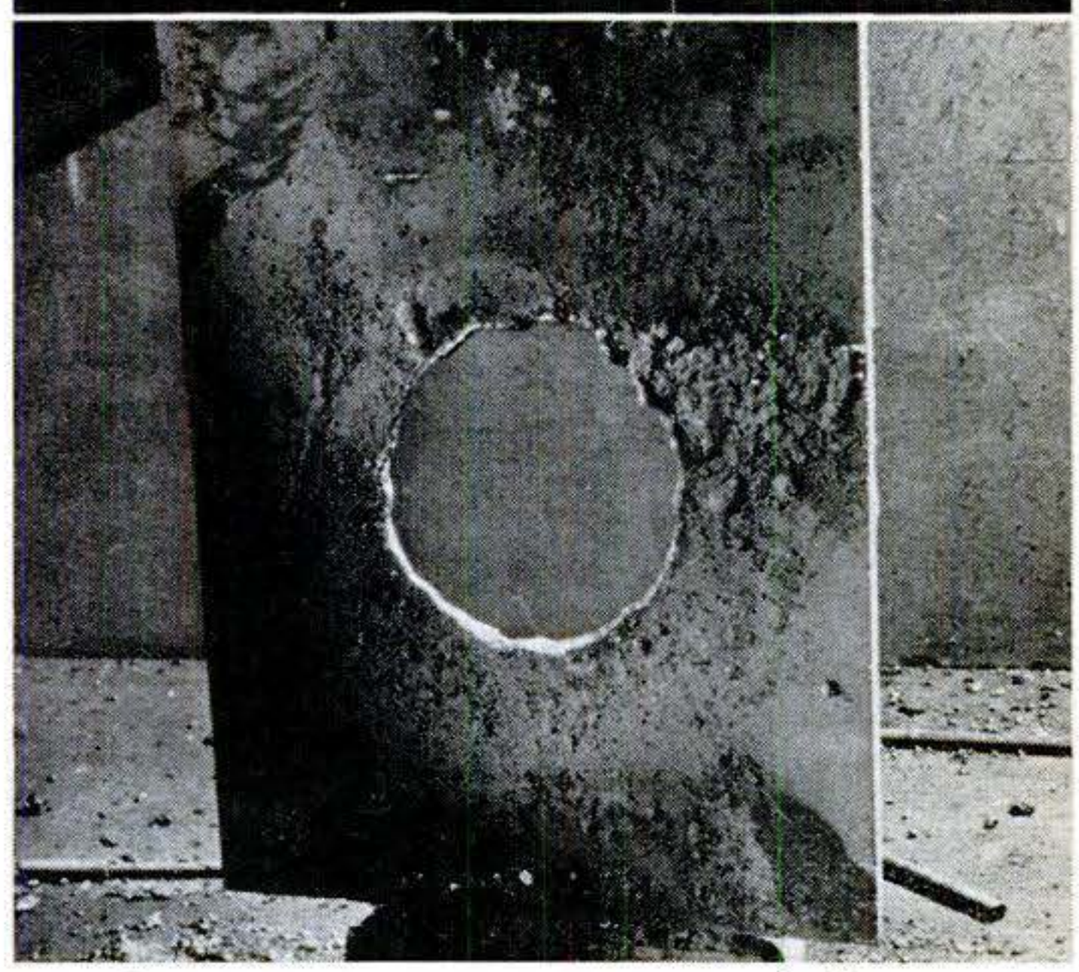
# Cuts Metal with Arc







**Gouging out cracks** is done with the electrode held at a shallow angle to the work, as in top photo. For cutting, rod is held at about 45° and advanced with a sawing or jabbing action.



**Inside cut** requires no starting hole. Expert Frank Romano first pierces the plate, and then moves along the cutting line with an in-and-out motion. Slag formed is easily knocked off.

Made by Eutectic Welding Alloys Corporation of New York, CutTrode® also chamfers edges, gouges out cracks or bad welds, pierces holes, and makes inside cuts without preliminary drilling. The coating focuses both heat and arc blast to control the cutting action; the blast helps blow the cut clean.

Unlike previous arc-cutting methods, CutTrode requires no extra equipment, gas, preheating, or special skill. Anybody capable of arc welding can use it immediately on AC or DC. With DC, the positive side is grounded to the work, making the electrode holder negative. Heats ranging from 80 to 300 amp. are used, depending on the electrode diameter and the thickness of the cut.

CutTrode comes in diameters of 3/32″ to ¼″, and will pierce a hole only 1/32″ larger than its size if desired. A special type is available for underwater use. END



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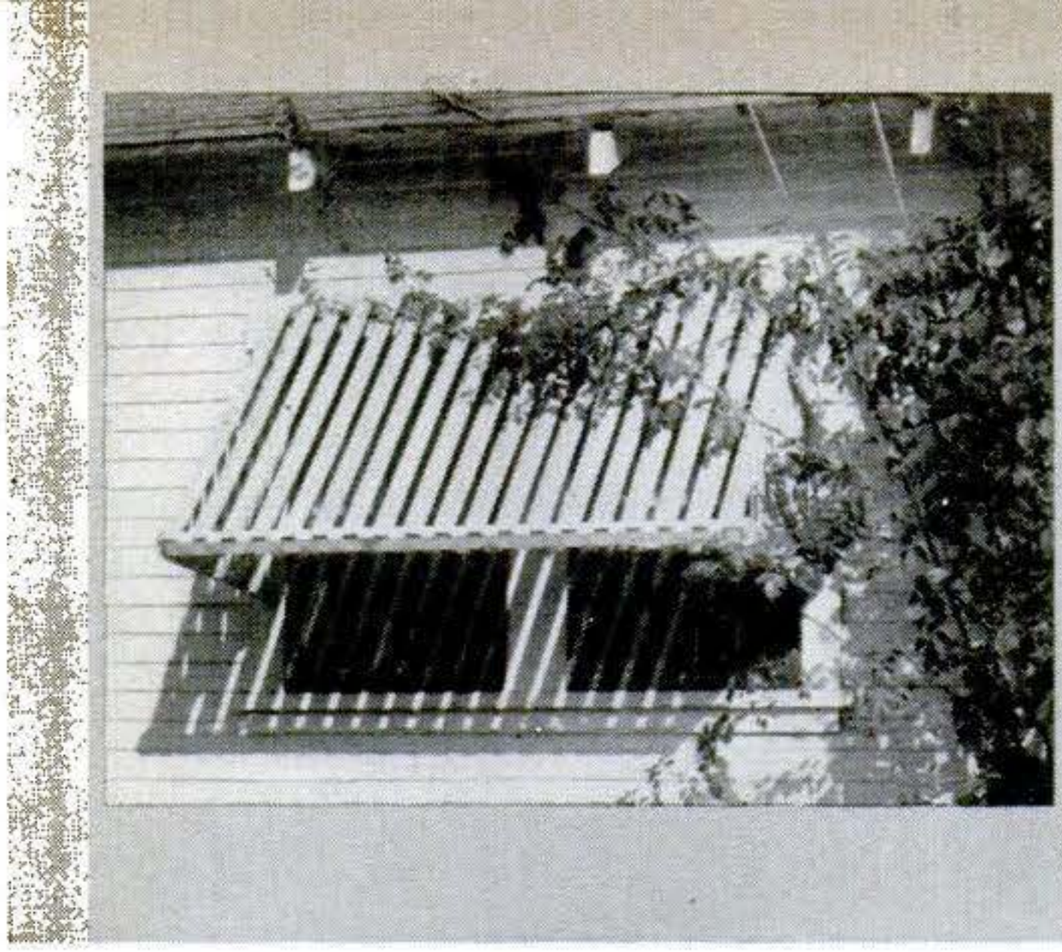
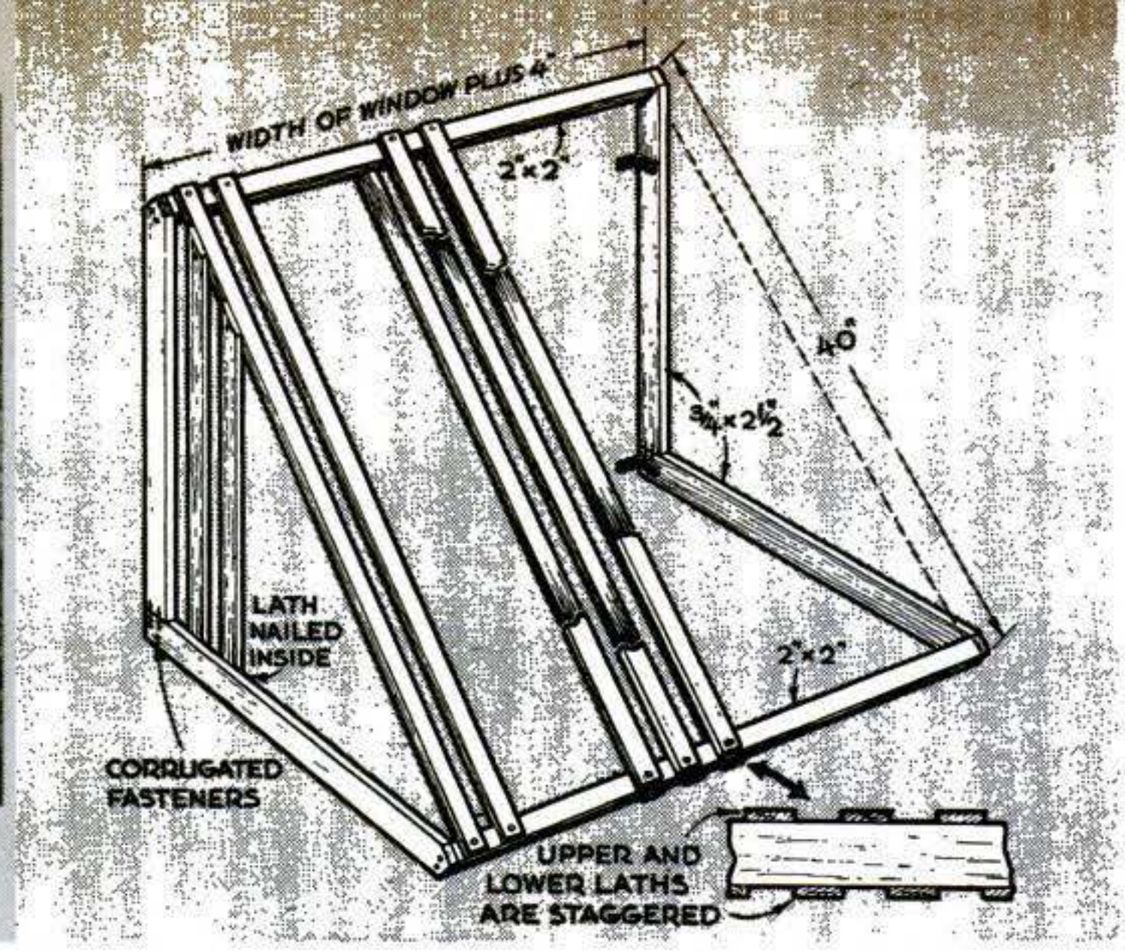
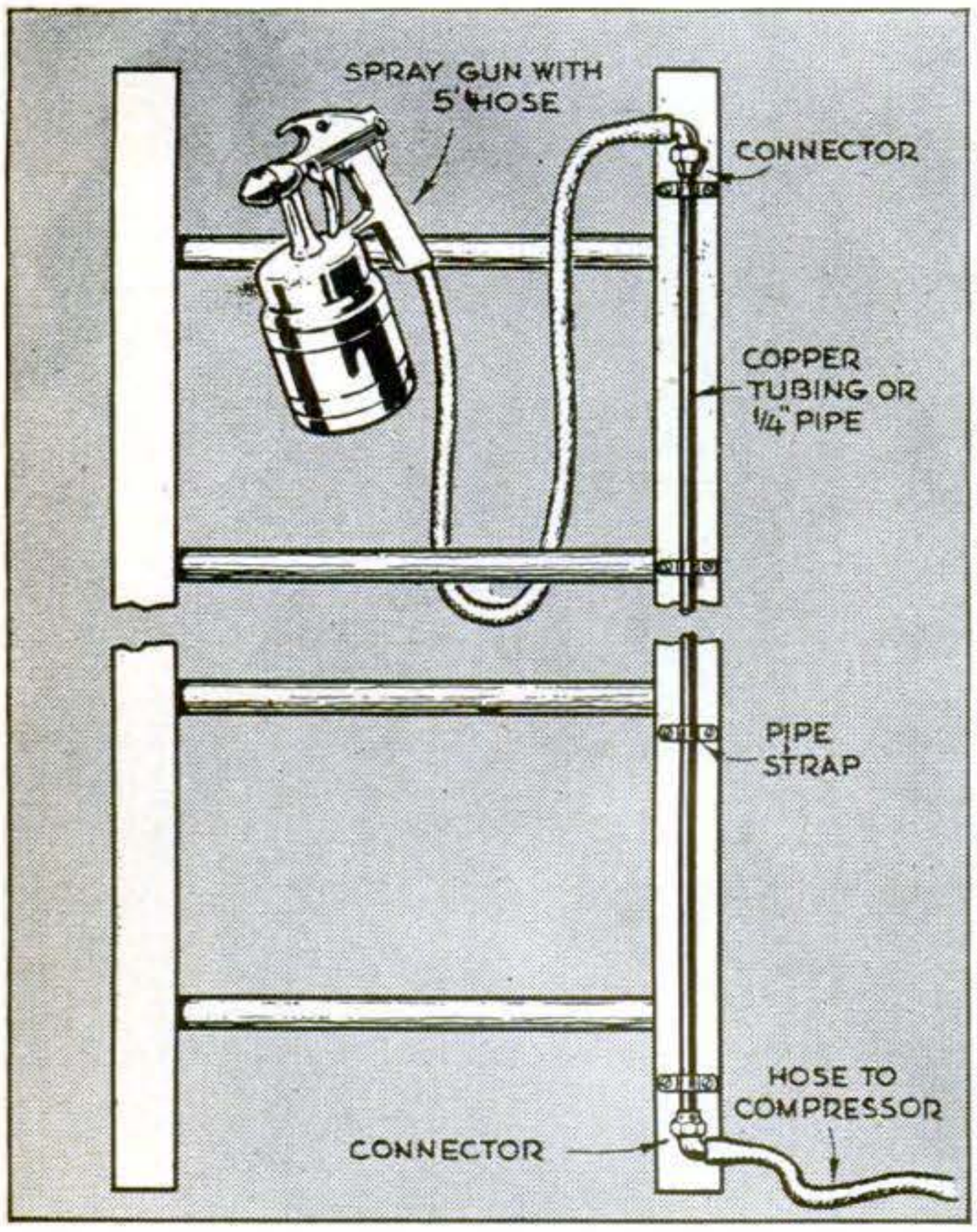





## Window Awning Made of Lath

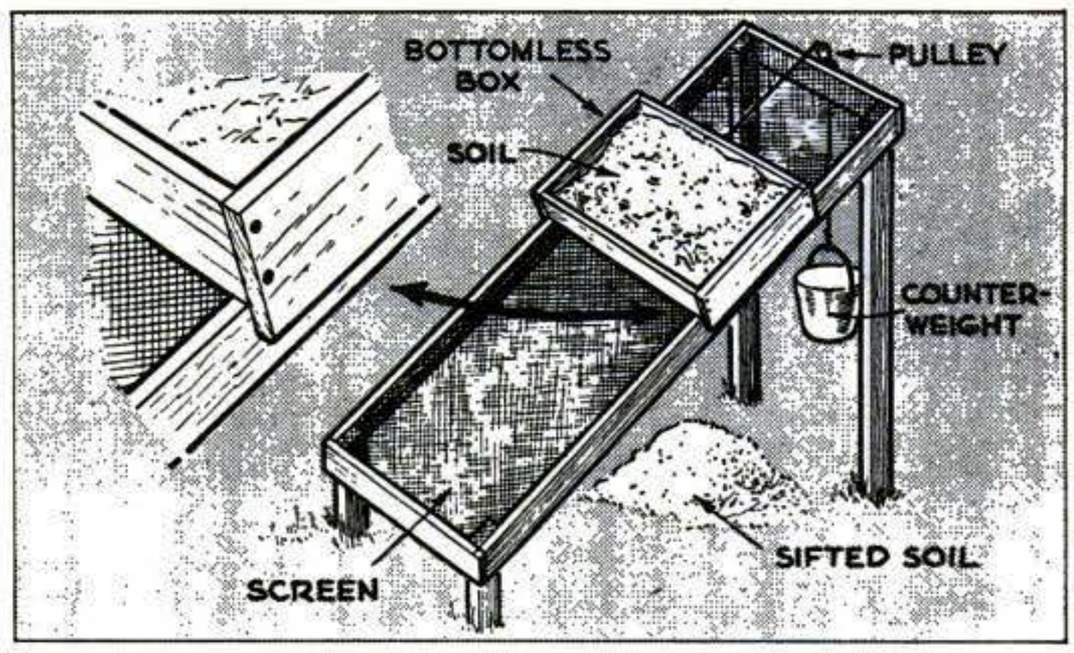
THIS ventilated awning looks good and is easy to put up. Nail building lath to 2″ by 2″ end pieces, spacing the slats their own width apart and staggering them on opposite sides of the end pieces. Then attach this to the side frames and nail on the vertical slats. Paint or stain.—*G. Hammerschmidt, Lakeview, Calif.*




## Pipe Extends Sprayer Reach

ANYONE who has spray-painted a building knows that a long length of hose can get pretty heavy when dragged up or down a ladder. A piece of pipe attached right to the ladder, as shown above, will overcome this.

On extension ladders, mount the pipe only on the upper section. If you can get them, the connectors between the pipe and the hose should be the type that have an automatic disconnect valve to shut off the flow of air. Or you can install a manual shut-off valve at the upper end of the pipe. Now you need only climb the ladder and go to work.—*John Kretzschmar, Monsey, N. Y.*

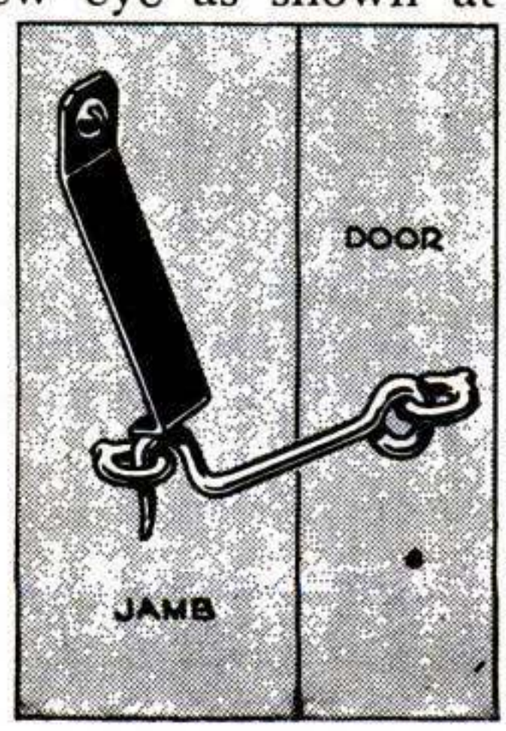



## Sliding Box Sifts Topsoil

SIFTING topsoil, loam, sand, or other materials can be speeded up with the setup above. When you shovel material into the bottomless box, gravity makes the box slide down the inclined screen. When most of the contents have sifted through, the counterweight pulls the box back up to be refilled. Smooth the box and screen to permit easy sliding.—*G. Burnley, Oakland, Calif.*

## Keeps Door from Locking

A PIECE of spring metal, bent and mounted over the screw eye as shown at right, will keep a screen door from hooking accidentally or being jiggled unhooked from the outside. Allow enough clearance between spring and wood so the hook can be engaged by pressing the spring inward.—*R. Hibben, Tulsa, Okla.*



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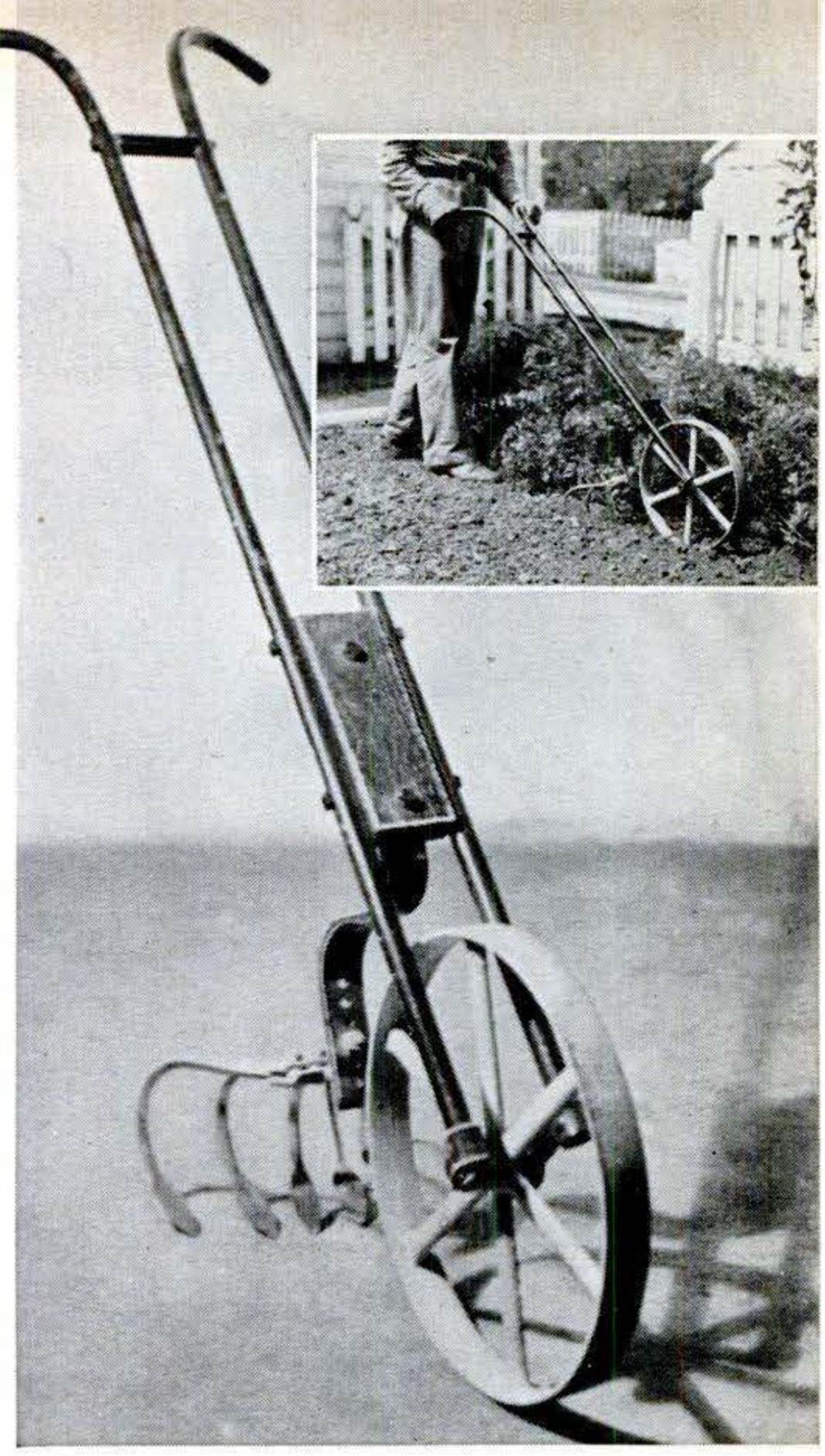
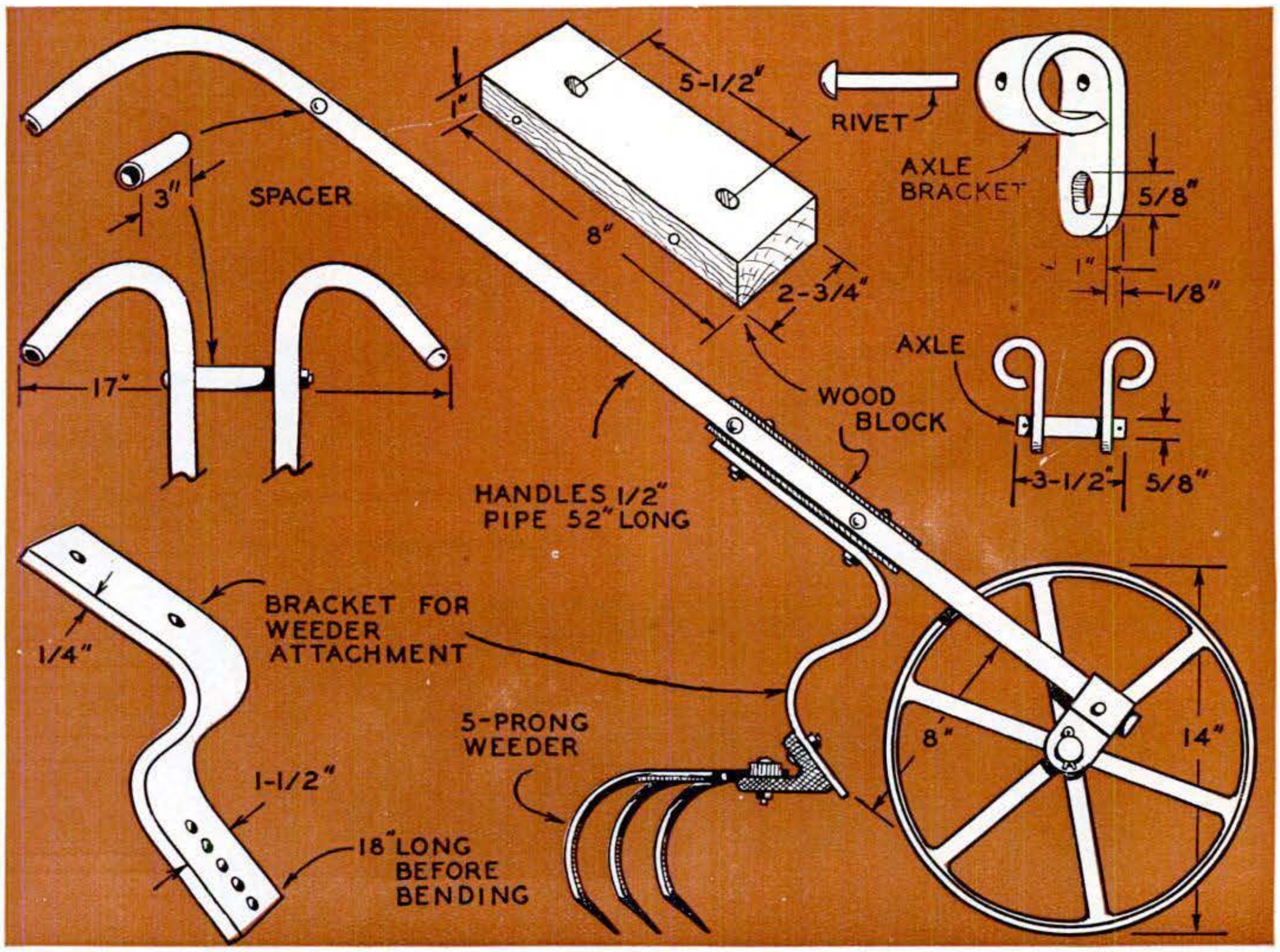
# Simple Cultivator Eases Garden Work

HOEING is slow and hard, but with this homemade cultivator, a good-sized garden can be worked up in a matter of minutes. It's built mostly out of scrap and pulls a five-prong weeder that you can buy in a hardware or farm-equipment store. I used a cast-iron pulley for the wheel; an old wheelbarrow or an ash-can dolly might supply one.

The axle brackets are strap-iron strips 5½″ long before bending. They're attached to the handles by ¼″ rivets. A hardwood or plywood spacer block is held between the handles by ¼″ by 5″ bolts. Near the top of the handles a through bolt and spacer pipe tie the handles together. Two 5/16″ by 2″ bolts attach the weeder bracket to the wood block. Five holes in this bracket let you adjust the height of the weeder.—*Harold Jackson, Kankakee, Ill.*





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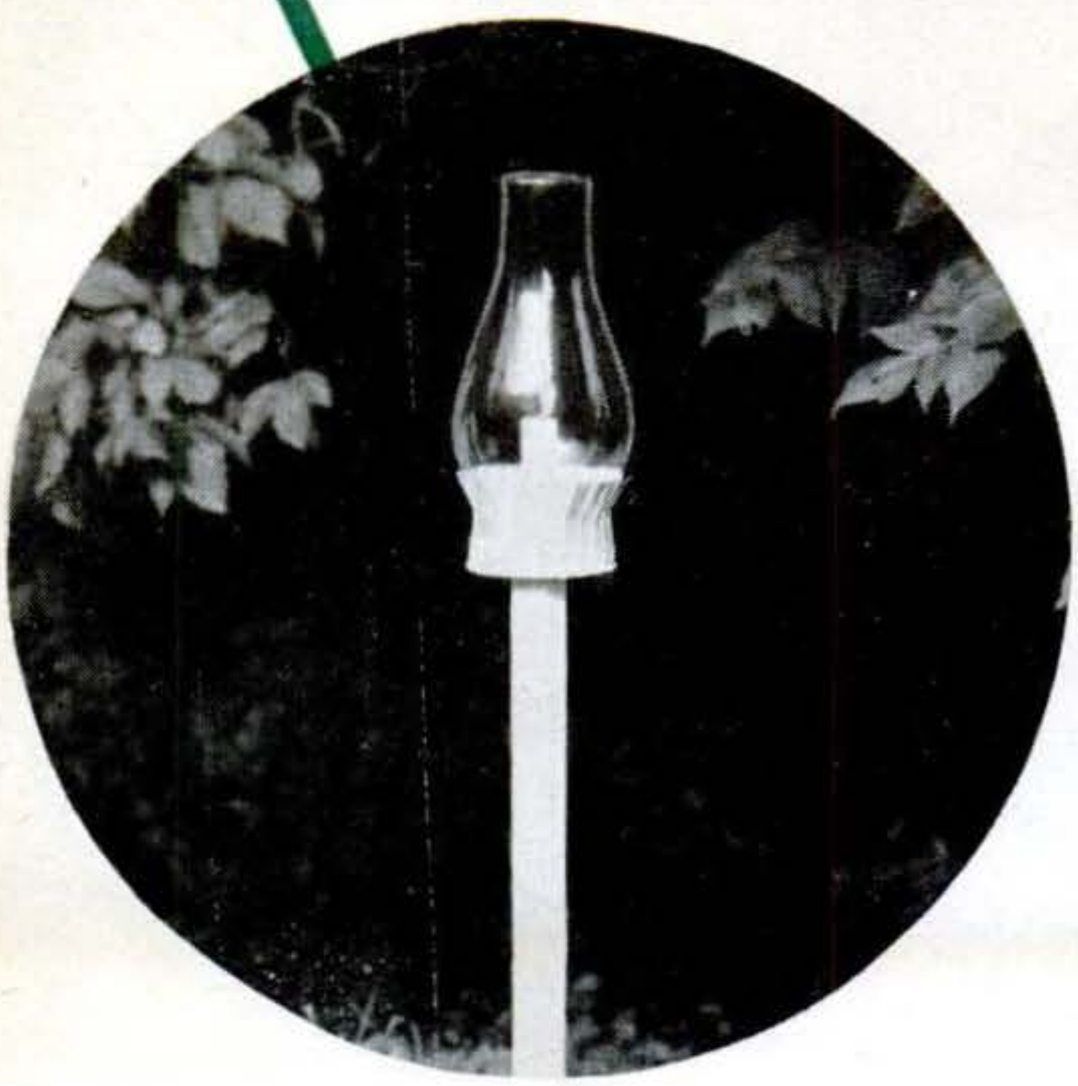
# Dine Outdoors This Summer



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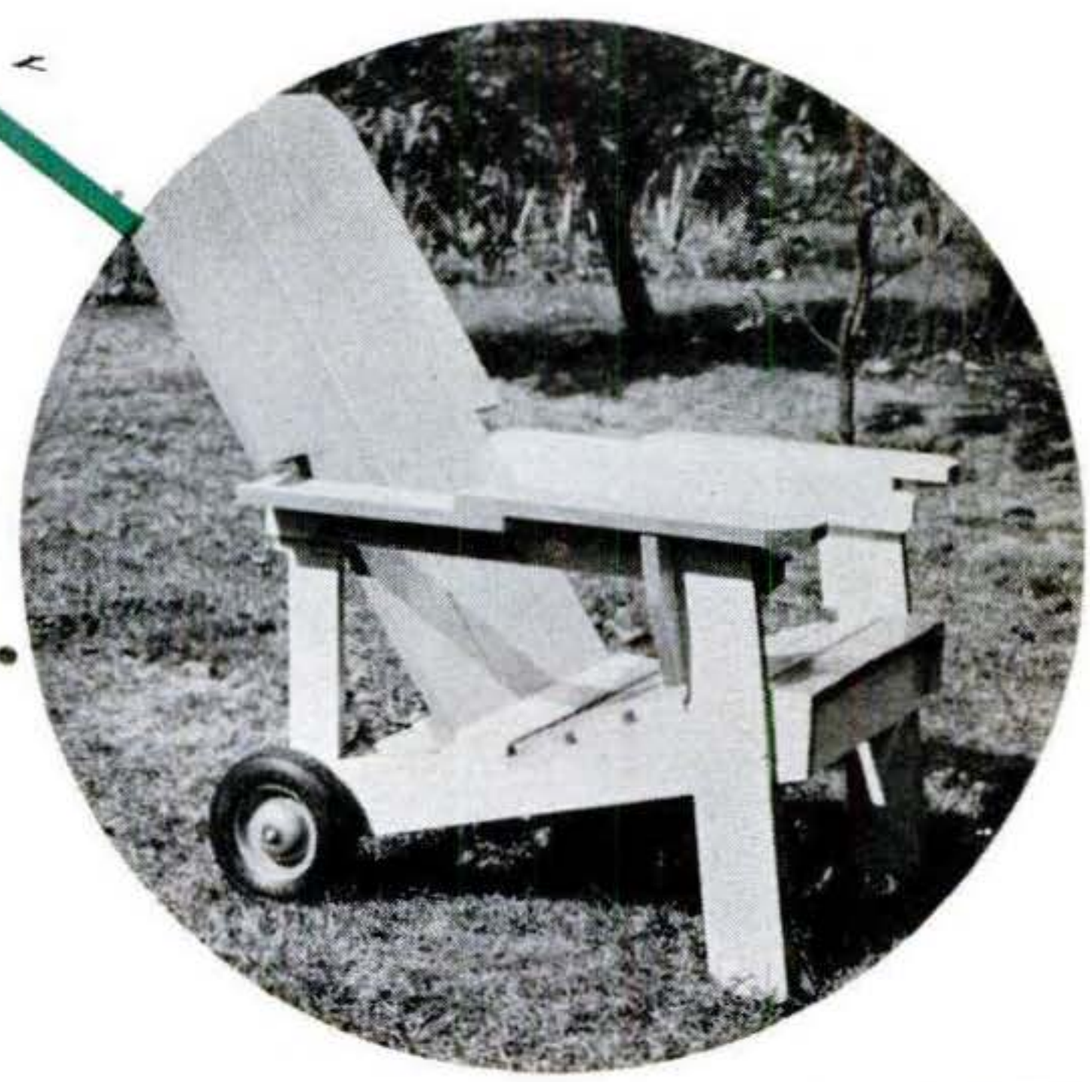
# With some easy shopwork now, you'll enjoy your yard more this summer.

PROPERLY furnished, your lawn or garden will be the equivalent of a roomy extension of your home this summer. On these eight pages you'll find plans for five pieces of outdoor furniture. There's a simple hurricane lamp built around an old tin can; a sturdy two-legged table; a portable grill with an electric food warmer; and a couple of chairs—one that folds up and one with wheels that can be rolled from spot to spot to take advantage of sun or shade.





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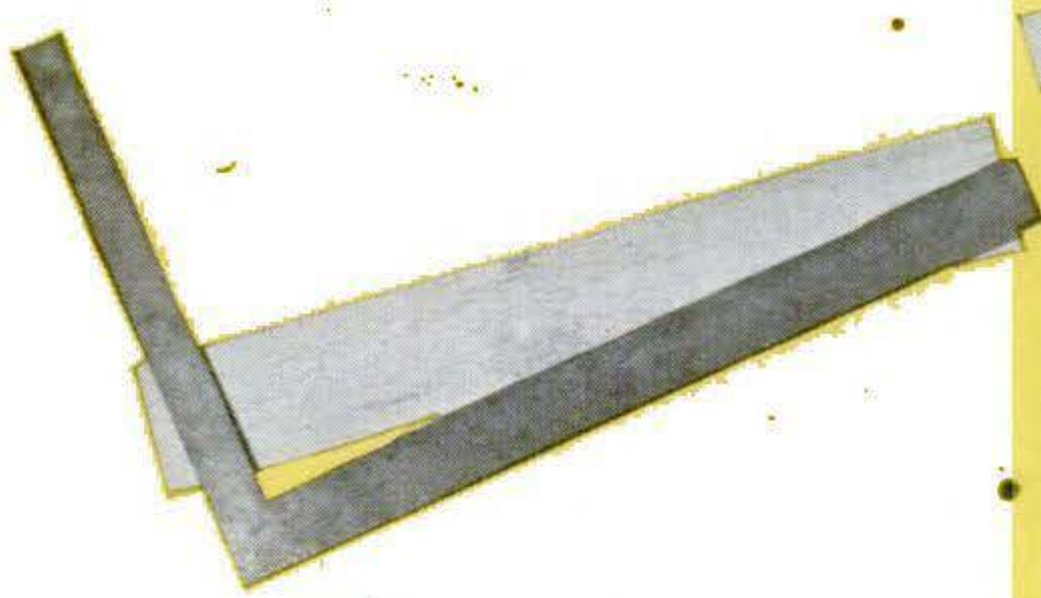
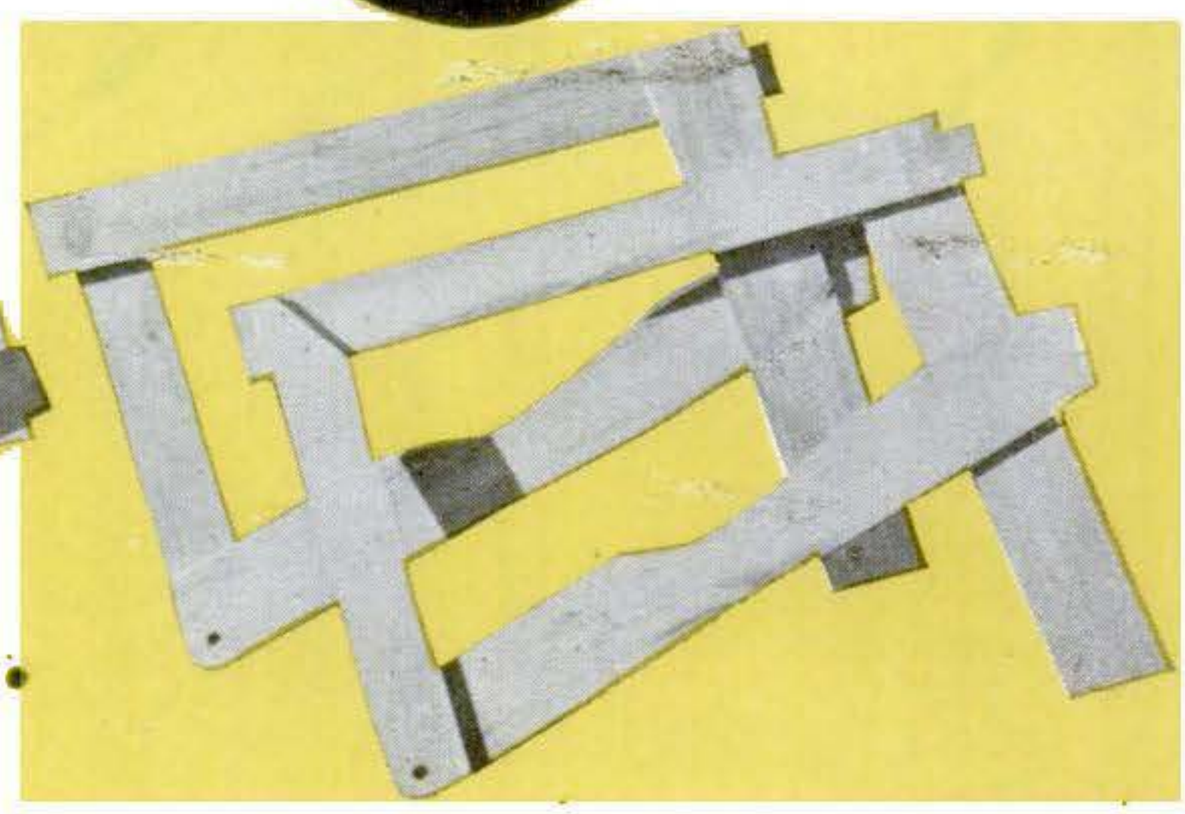
## With the back placed on the arm this chair serves as a table.

YOU'LL get lots of use out of this combination chair and table. The back is not fastened to the body of the chair. It can be lifted out and turned over for a 24″ by 36″ table top. And the wheels make it easy to move the chair in or out of the shade.

**Above are two views** of the finished table-chair. Back of chair is easily removed to form the table top.



**Framing square is used** to find angles on ends of front legs. Lay off 21″ on blade of square and 3″ on tongue. Make cuts at same angle on each end of legs.



**Assembly starts with sides.** Screw front legs and arm supports together. Then attach back legs. Seat supports come last, but don't screw them on solidly. Just fit them to the legs.



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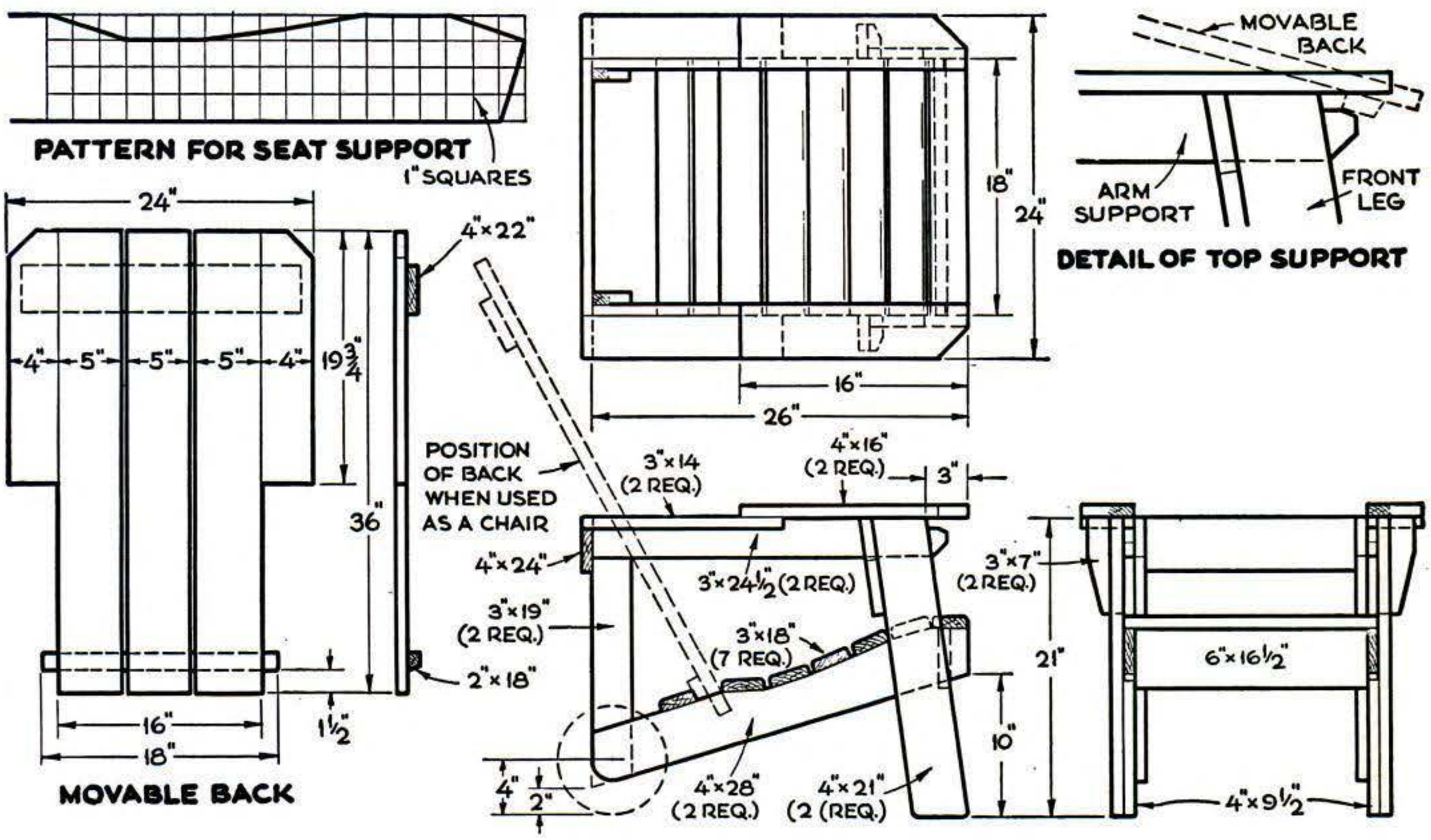
Most of the pieces can be cut from standard-width lumber. This makes the chair an easy hand-tool job. All pieces except the legs and seat supports are cut with square ends. The pattern for the seat supports is given on squares in the drawing. One of the photos shows you how to get the angle for the ends of the front legs.

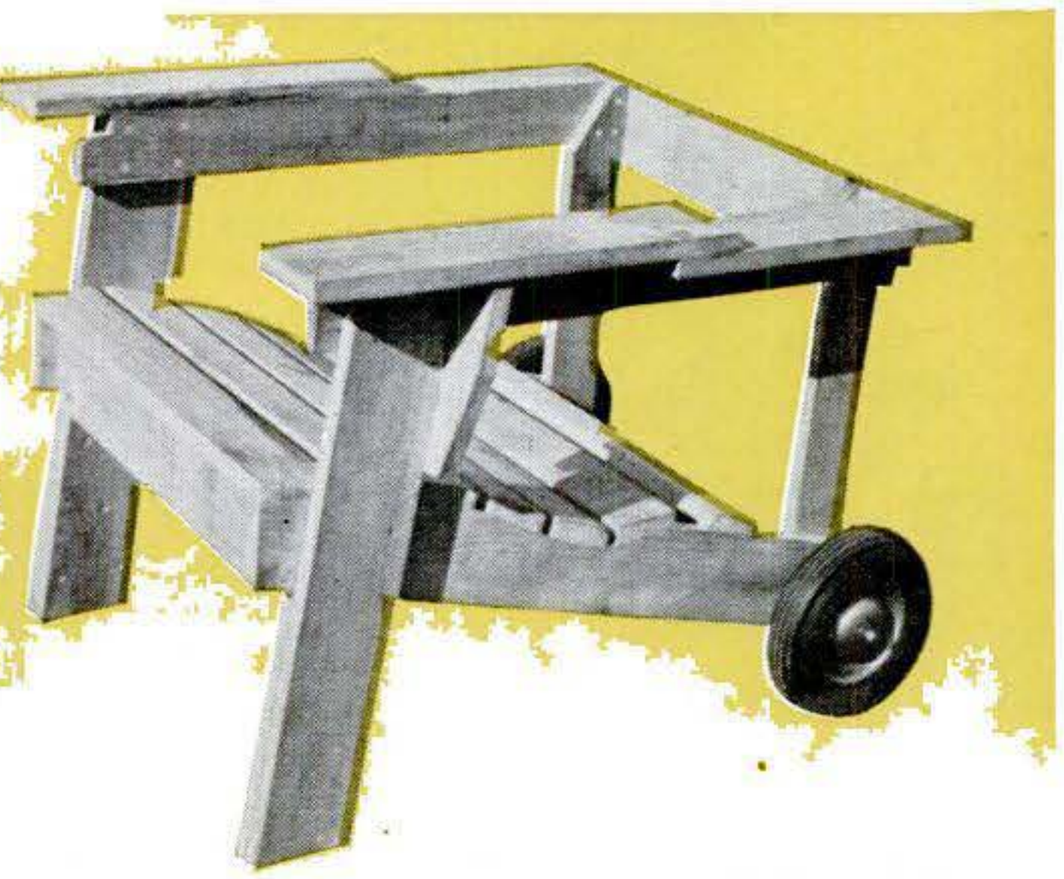
Start assembly of the chair with the sides, using 1¼" No. 8 wood screws. The slant of the back is determined by the angle cut in the top of the rear legs. Suit yourself about this, but be sure you make the cuts alike.

The wheels shown in the photos are 8" in diameter. If you use wheels of a different size, change the axle location so the arms of the chair will be level.

As you assemble the parts, round and smooth the corners. The 1" by 2" by 18" cleat across the bottom of the back fits into notches in the front of the arm supports when the unit is used as a table. It may be necessary to give the notches a slight downward slant. Then the cleat will slip into place more easily when you put on the table top.



**After fitting,** seat supports are removed and the seat boards nailed to them. Front board is flush with front of seat supports. Six boards are for seat. Seventh holds back.



**Completed chair.** The 1" by 6" by 16½" brace across the front should be well nailed so front legs will be rigid. Eight-penny box nails are used to fasten on seat boards.



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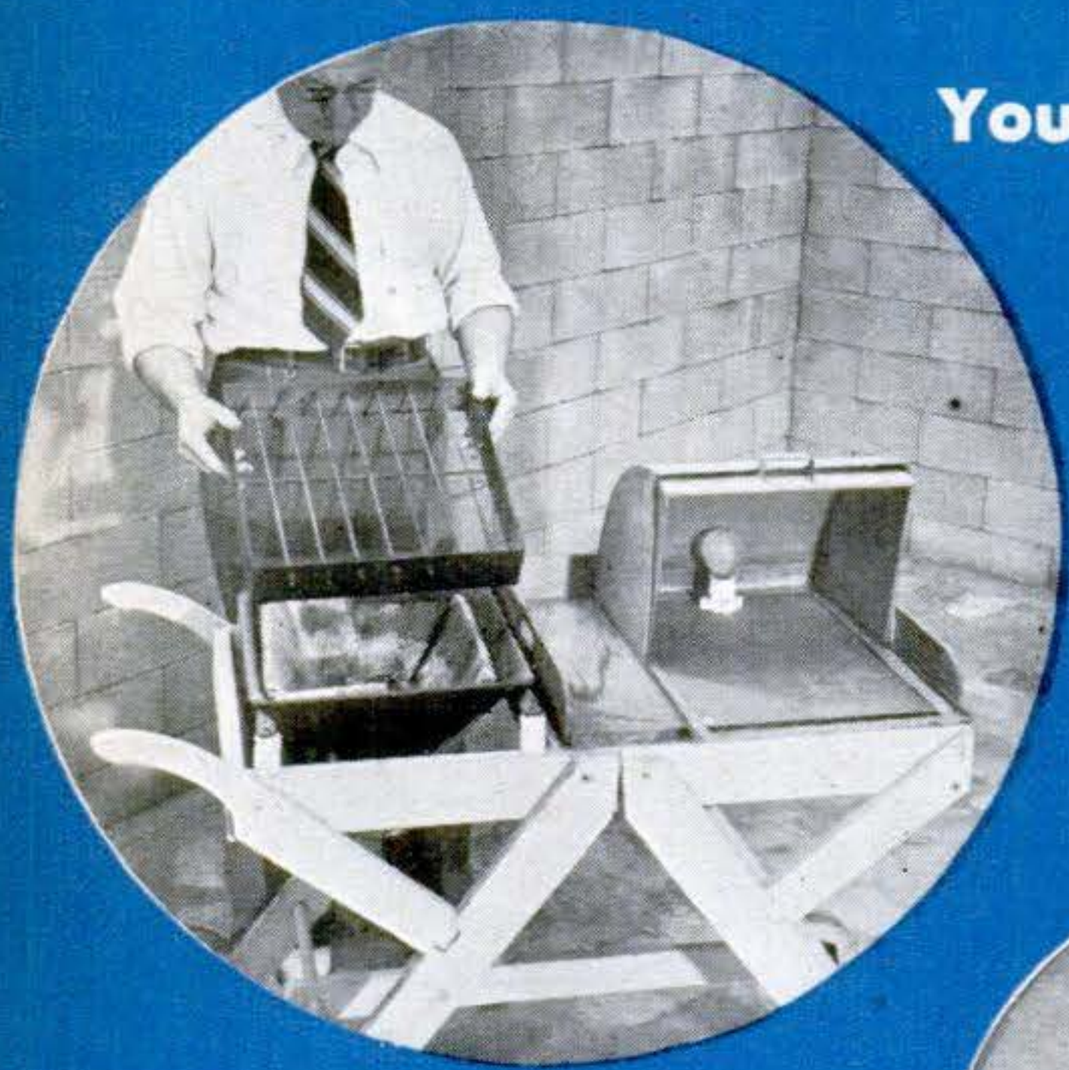

## You can roll your dinner right up to the table on this grill.

YOU'LL like this portable grill. It's easy and inexpensive to build, and it keeps food warm until ready to serve.

The warmer is an old one from a lunch-room. An electric bulb is mounted in it to

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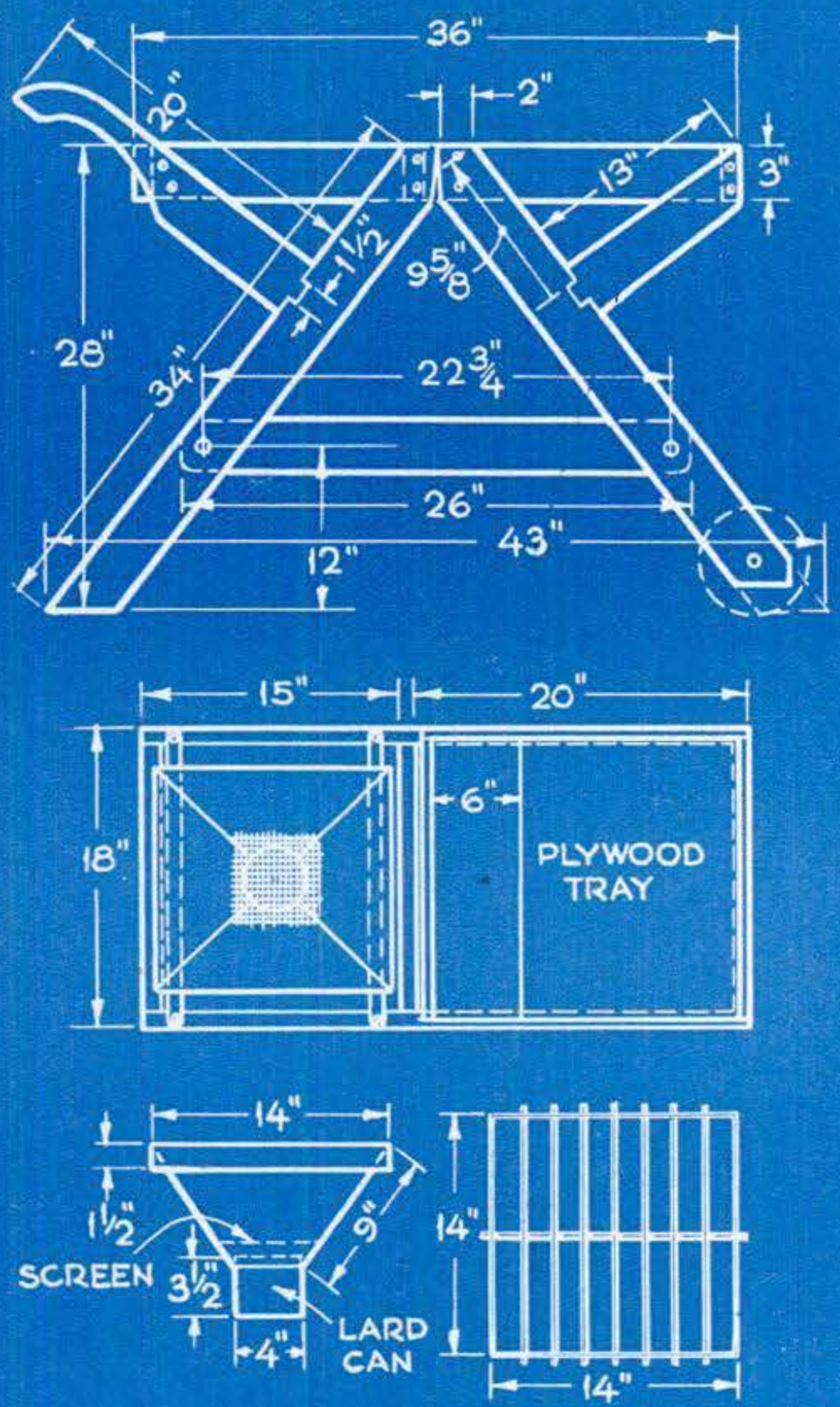
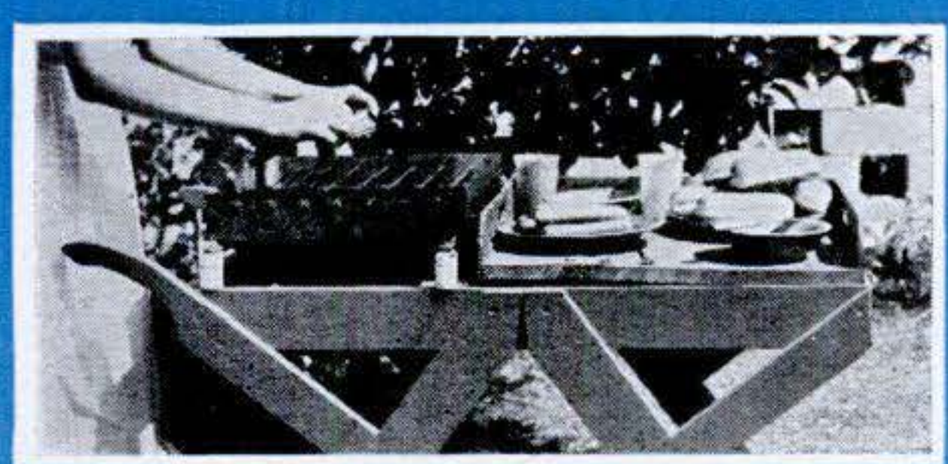
maintain heat. If you don't have an outlet handy, you can omit the bulb.

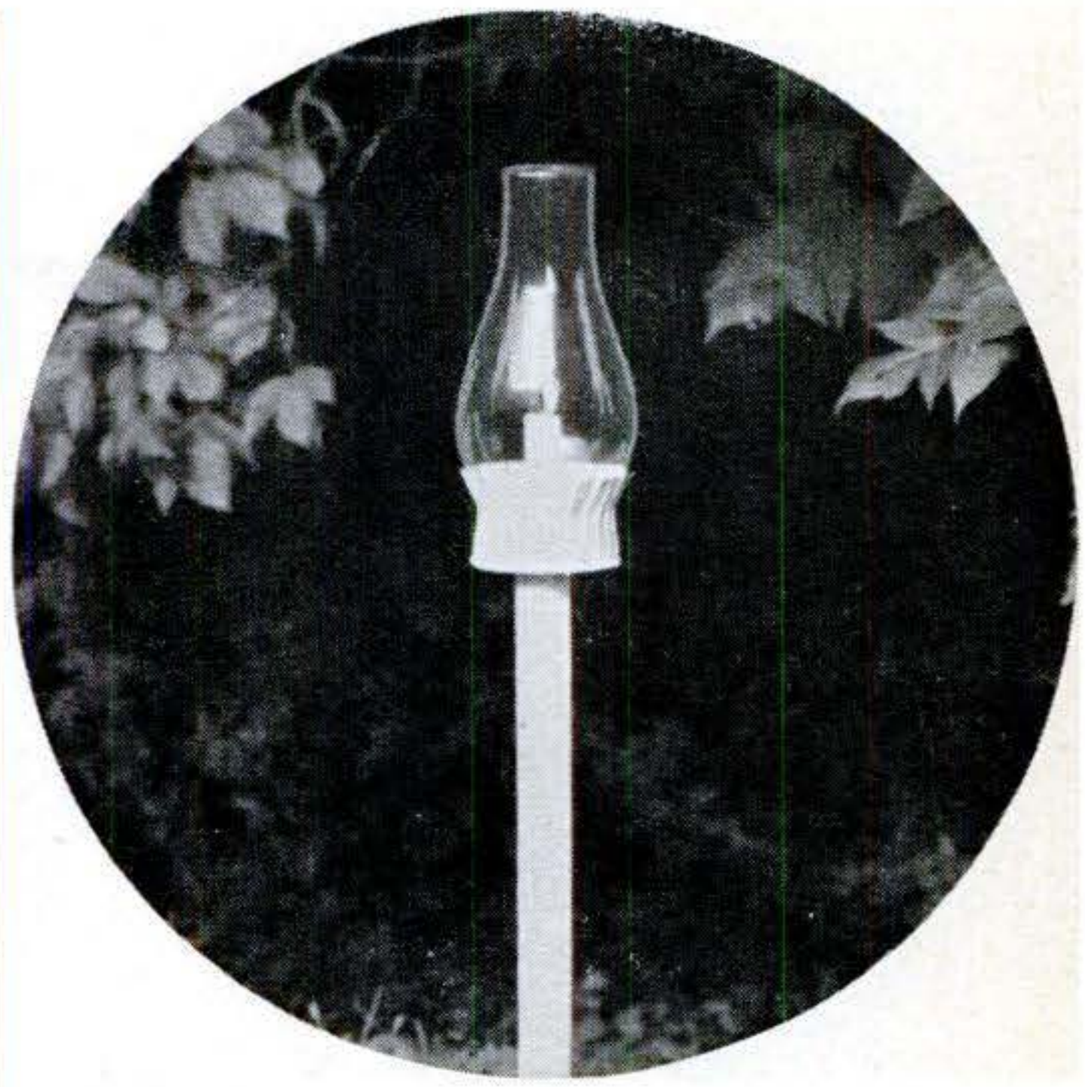
You can make the grill and fire pit yourself or have the work done by a tinsmith. The lard can wired to the fire pit catches ashes. Such units are also sold complete by many hardware stores.

The legs with the wheels are cut 1¾" shorter than the others, the wheels making up the difference in height.



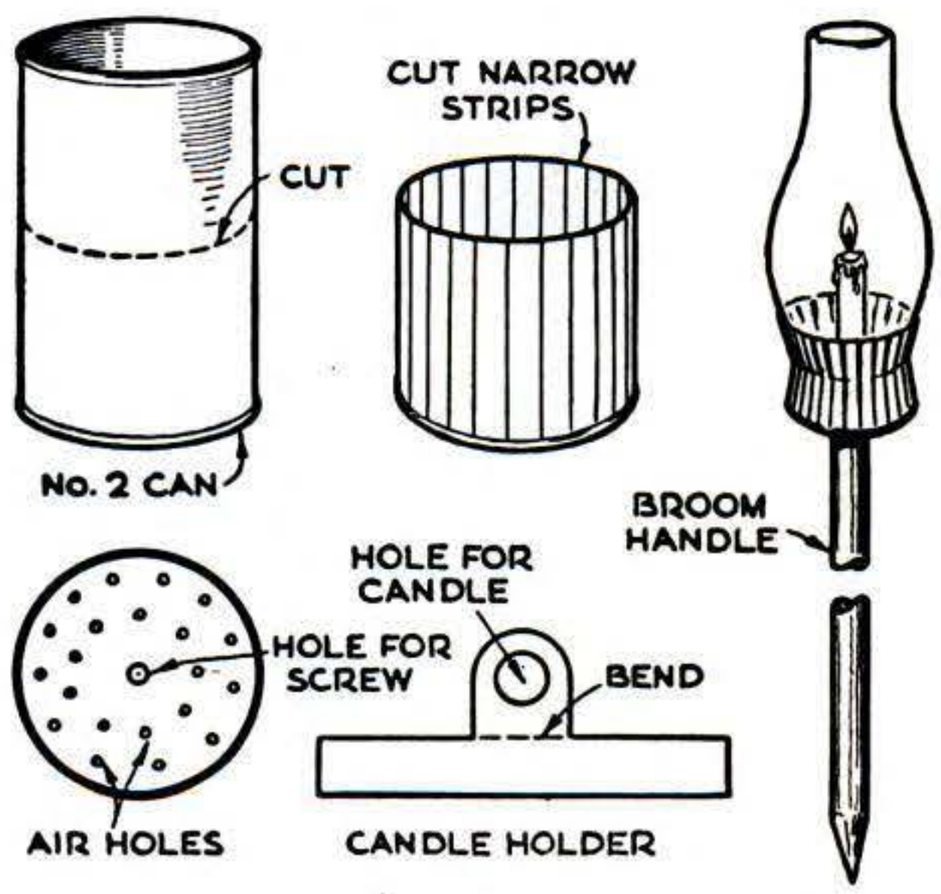
**With the food warmer removed,** the tray on the end of the cart holds dishes, food, and cooking utensils. It also may be used as a serving tray.



## Old tin cans and standard lamp chimneys make these low-cost hurricane lamps.

FOR REAL enjoyment of your yard during summer evenings, you'll want some lights. This attractive hurricane lamp is easy to build and can be moved quickly to new locations. It's mounted on a pointed pole that is simply pushed into the ground.

The drawing below shows you the steps in making this type of lamp. Use tin snips to cut the can in half. Make the narrow strips about ⅜" wide. Cut the candle holder from the top part of the tin can and bend the arms around to form a circle. After the base is mounted with a screw, bend the ⅜" strips inward at the center and outward at the top. Use a No. 2 lamp chimney. The lamp should stand about 5 feet above the ground.



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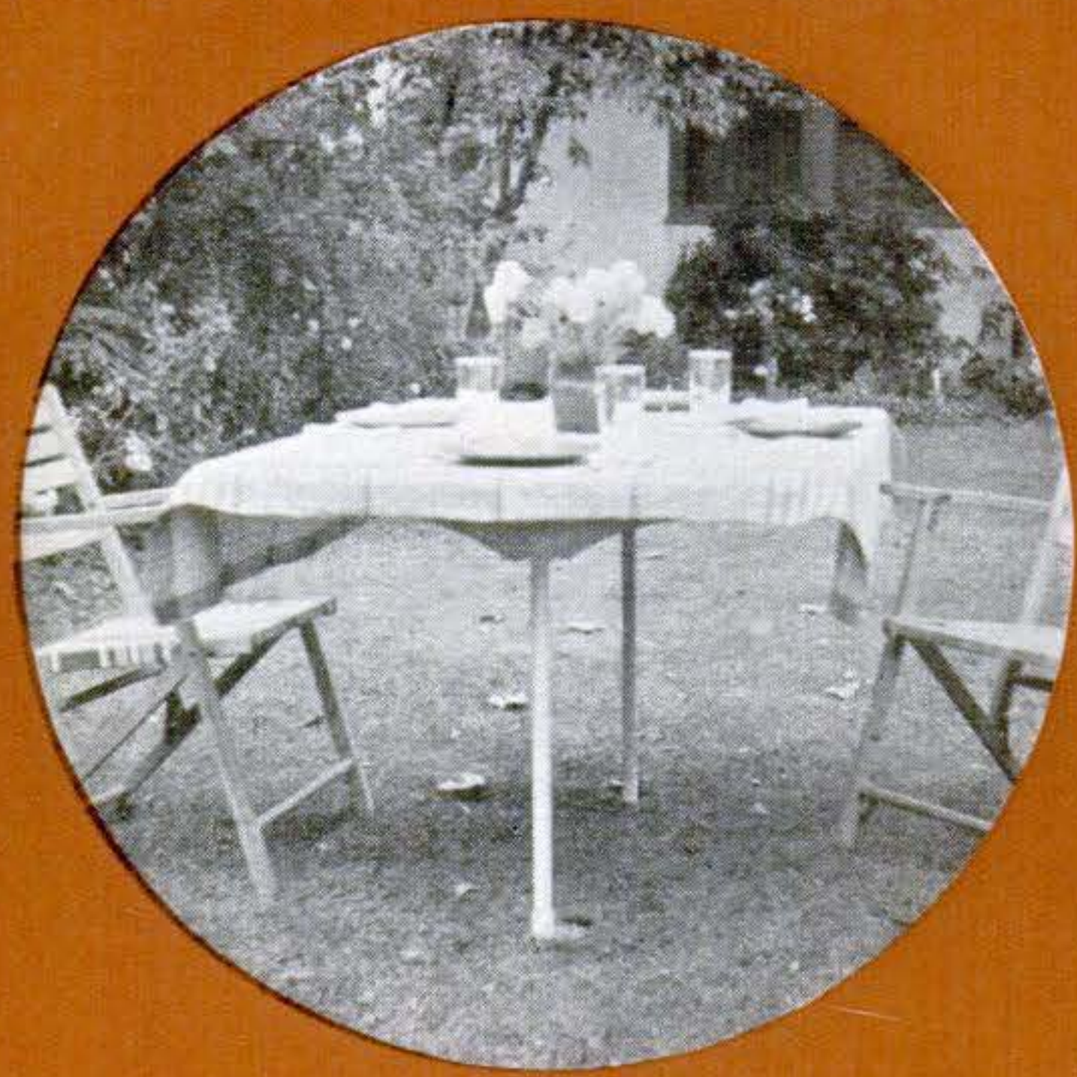
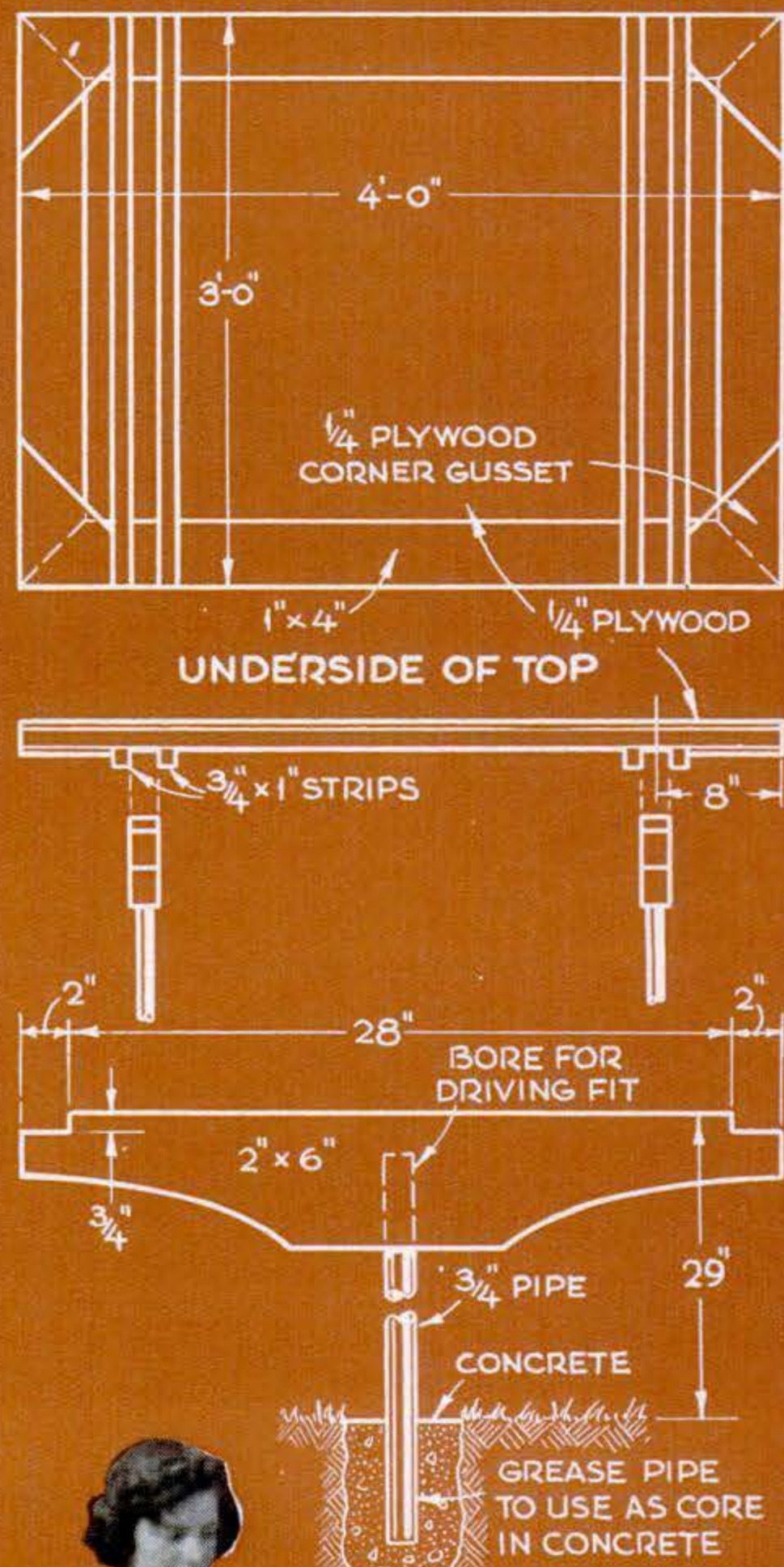


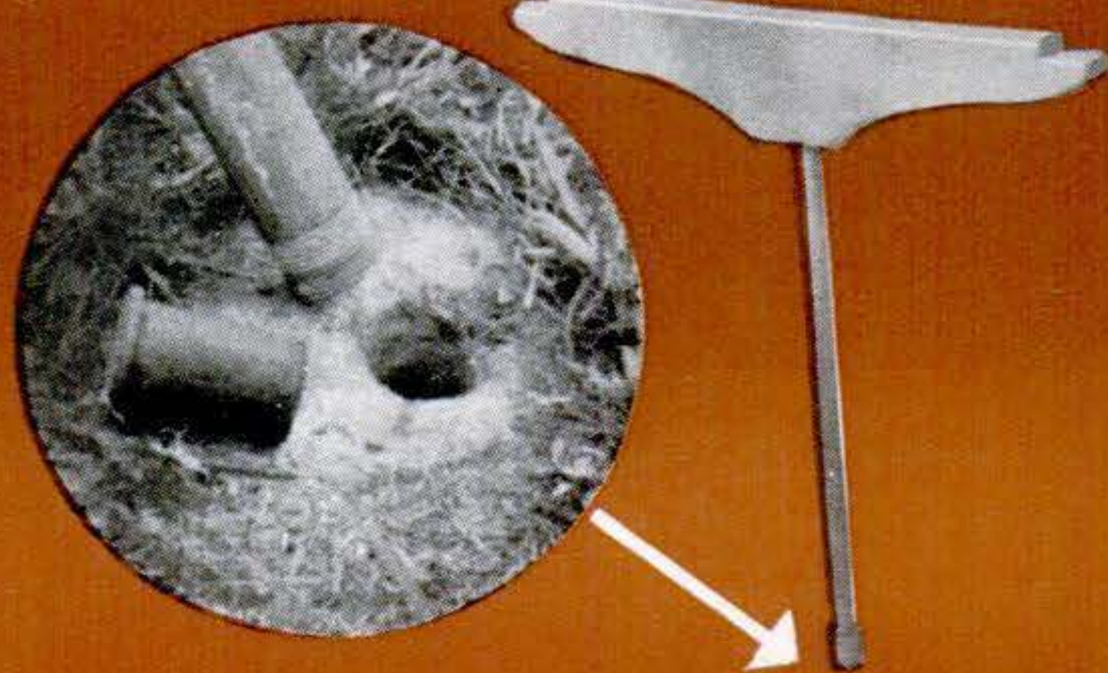



## Dining table can be removed for storage.

If you like to dine outdoors but don't want your lawn cluttered with permanent furniture, here's the table for you.

It's lightweight and portable. The pipe legs fit into concrete sockets set in the ground. When not in use, the table top is removed and the legs pulled out of the sockets for storage. The sockets are closed with iron plugs.

After you've selected the location for the table, dig 6"-diameter holes for the concrete leg anchors. Grease the pipes, set them in the holes, and pour concrete around them. As soon as the concrete has set, remove the legs. The plugs will keep out dirt.





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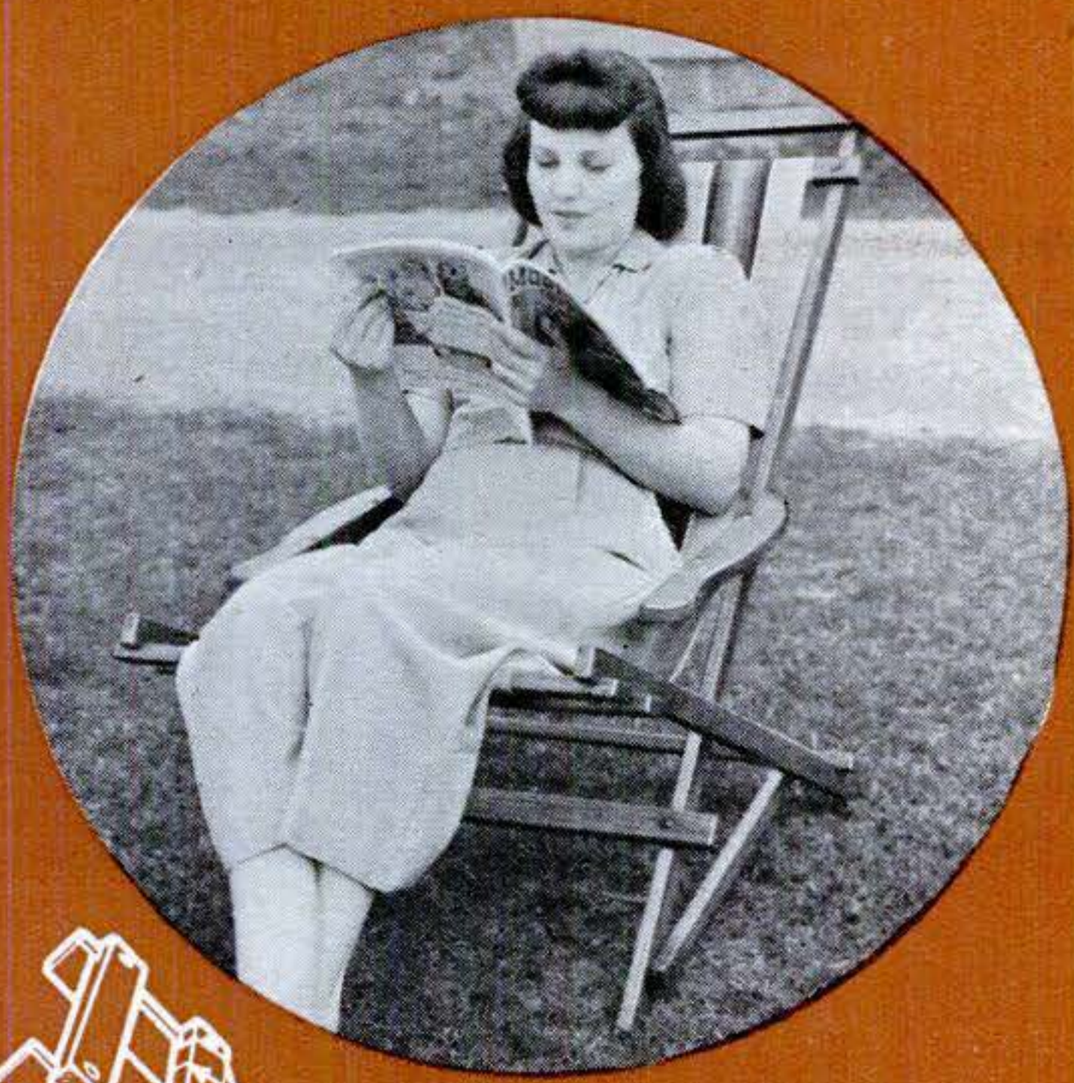
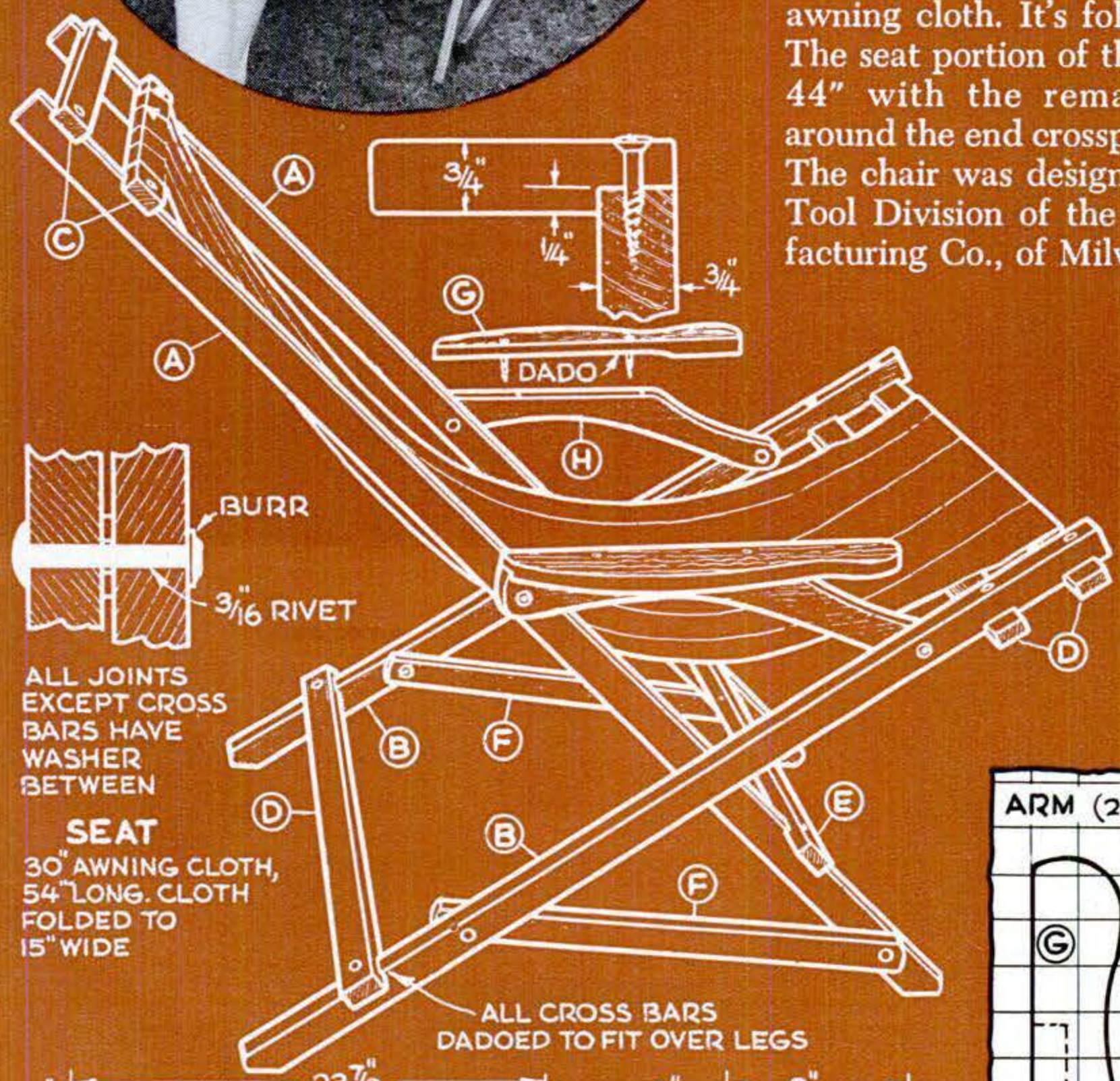


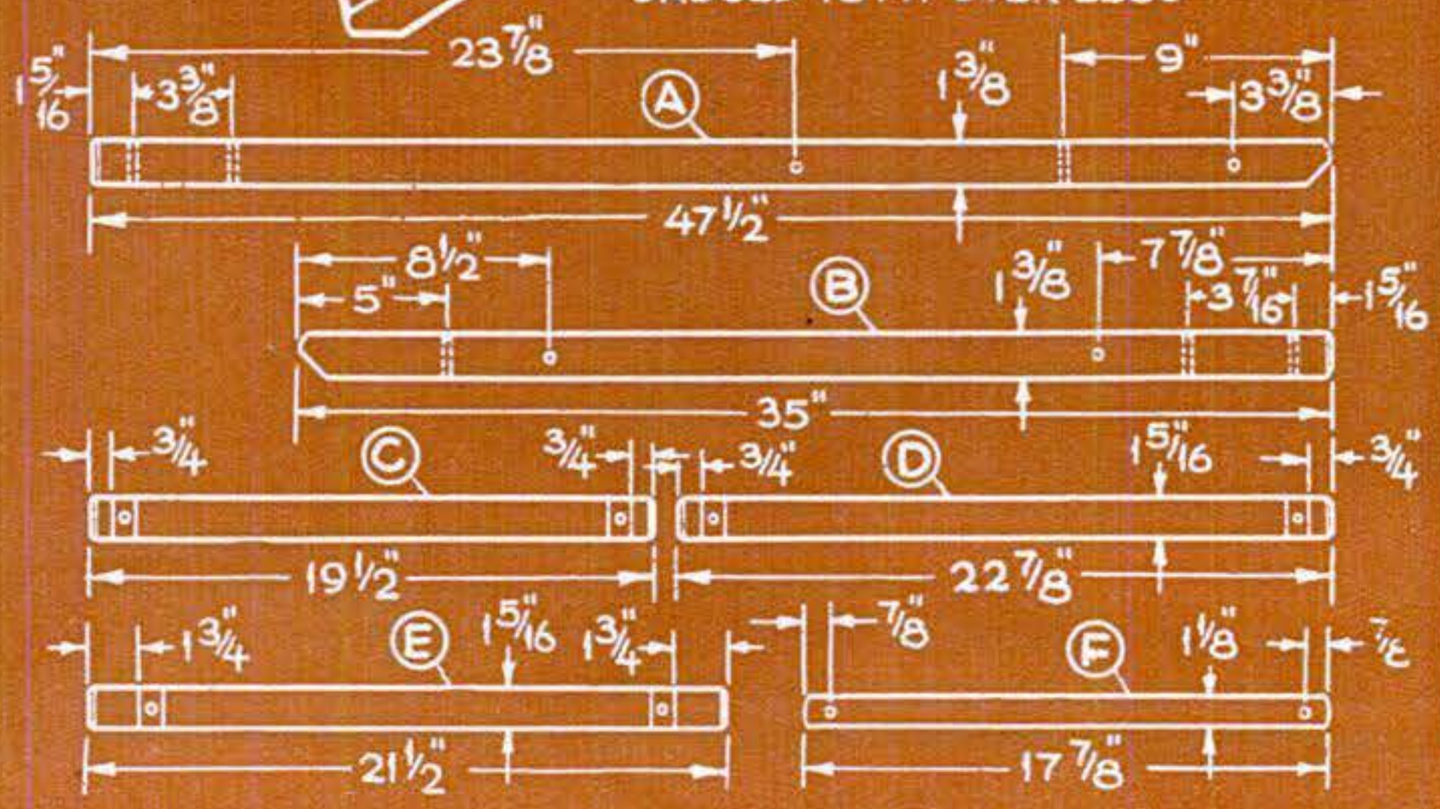
# For reading or snoozing, here's a comfortable folding chair.

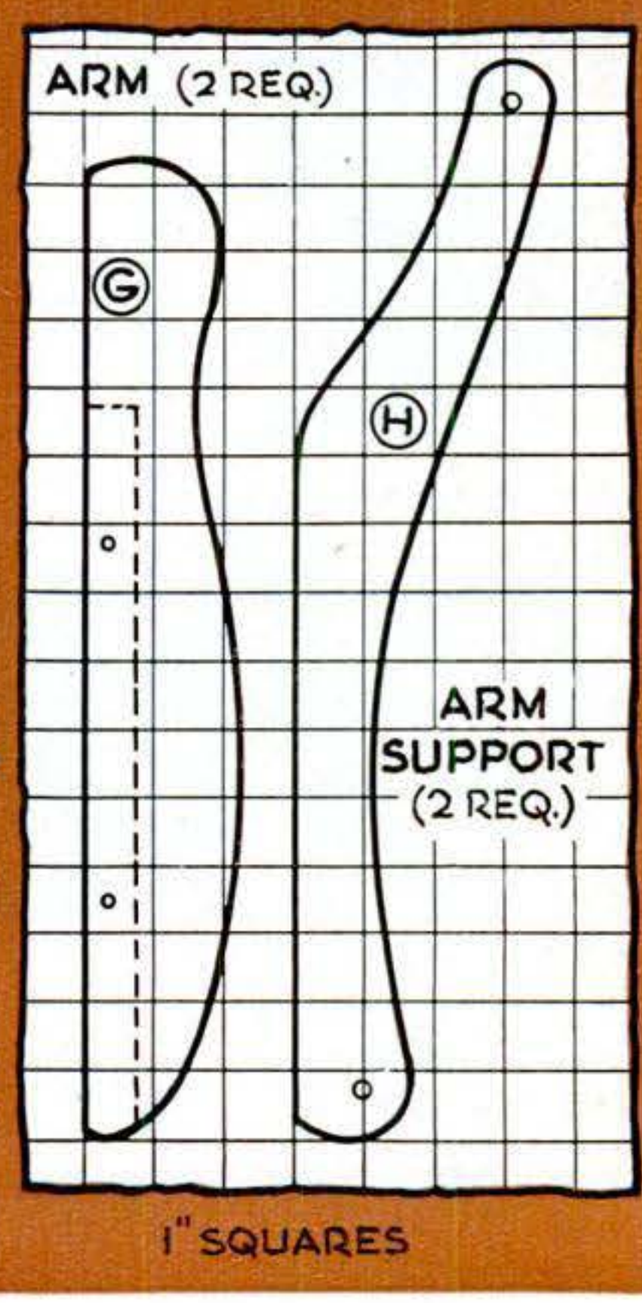
ALL the parts of this glider chair are cut from ¾" hardwood. The holes are 3/16" to take 3/16" rivets or bolts. The joints—except on the crossbars—have a washer between the parts.

Edges should be rounded and painting or varnishing done before the cloth seat is attached to the frame.

The seat is a 54" length of 30"-wide awning cloth. It's folded to 15" wide. The seat portion of the cloth measures 44" with the remainder wrapped around the end crosspieces and tacked. The chair was designed by the Power Tool Division of the Rockwell Manufacturing Co., of Milwaukee, Wis.



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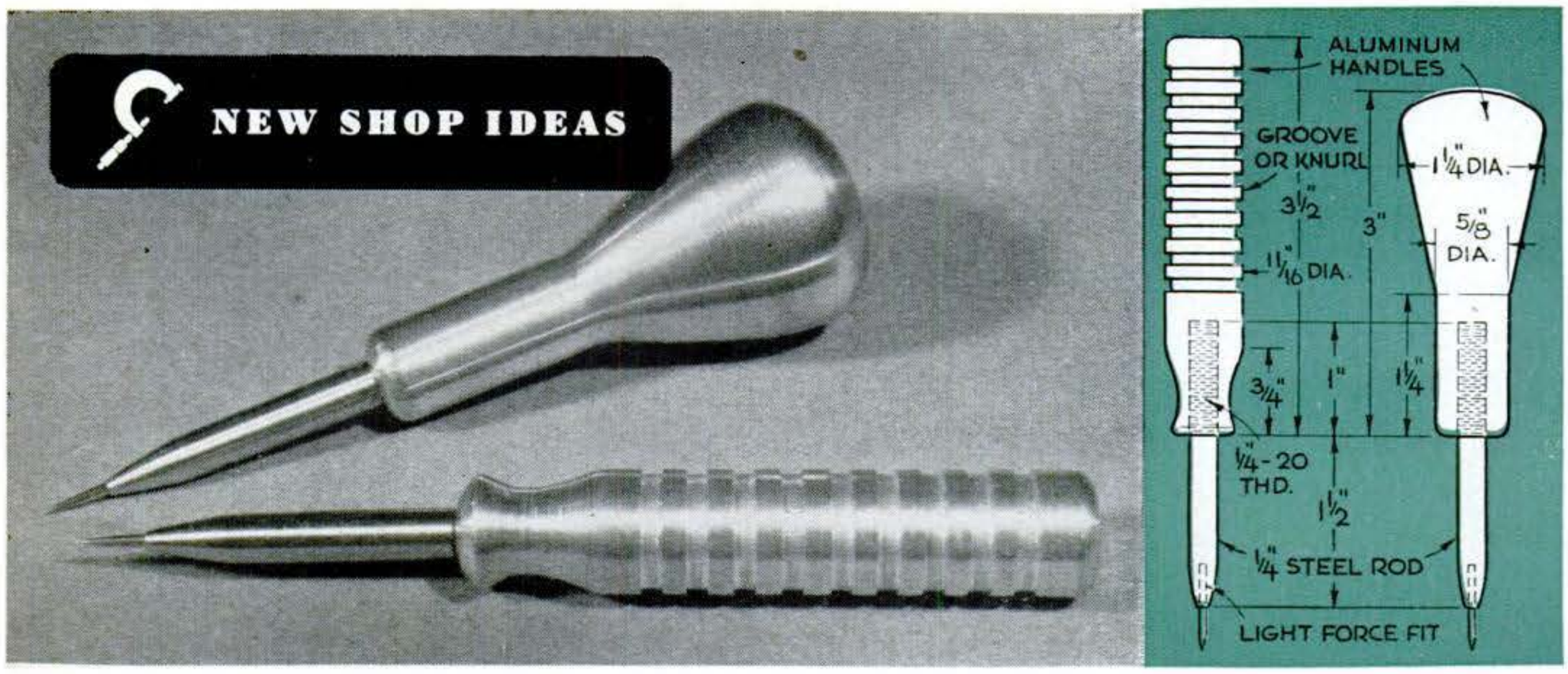
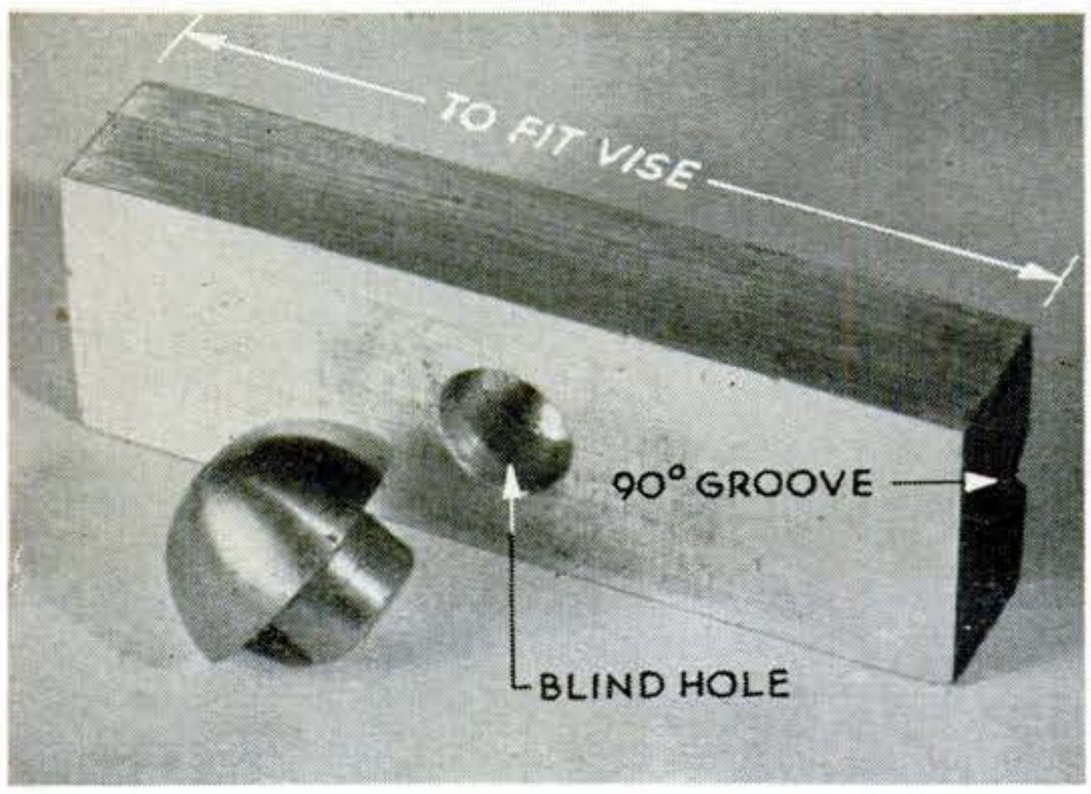
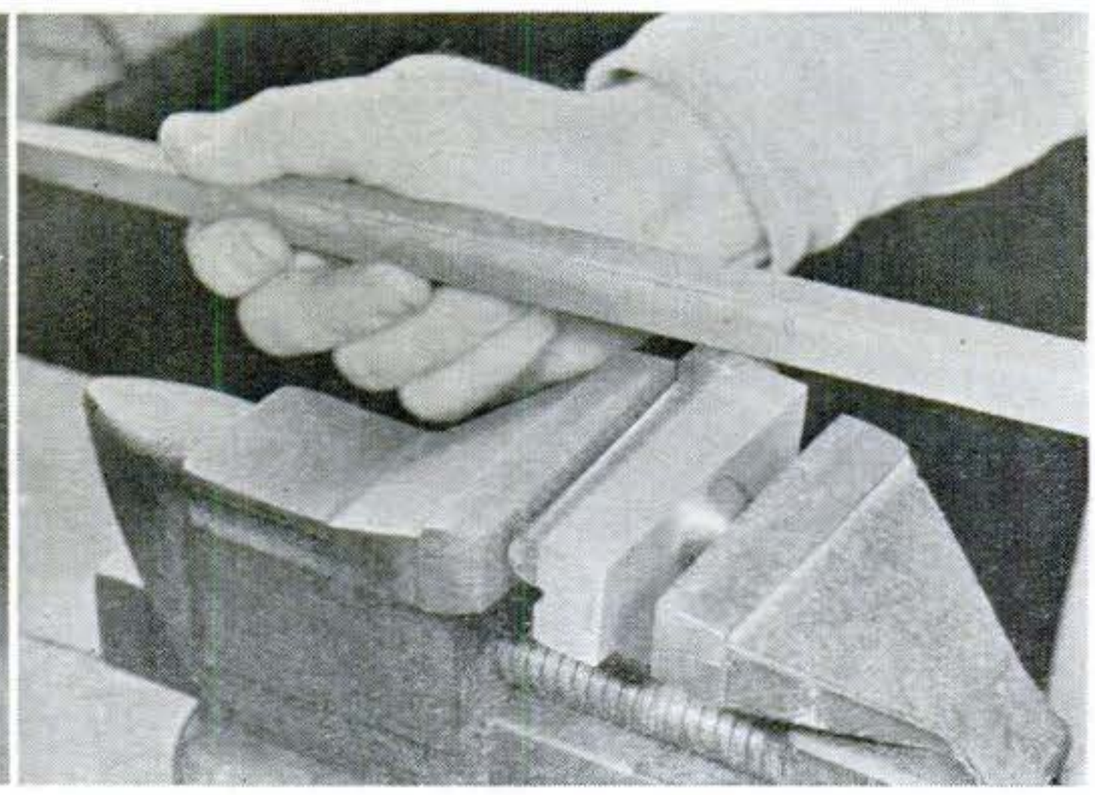


**Scriber Points Are Renewable.** Every shop can use extra scribers. These are light in weight, fit the hand comfortably, and last practically forever. They're just an evening's easy lathe work.

Into aluminum handles are screwed steel inserts that hold phonograph needles. These are very hard, and remain sharp for months of use. When dull, they're easily replaced.

Rough stock for the handles is first drilled and tapped, and then turned to shape, cut off, and polished. The straight-shank scriber may have finger-grip grooves cut with a parting tool, or it may be knurled. Cold-rolled steel rod is threaded with a die, pointed, and drilled a force fit for the needles. These can be inserted by holding them on a lead block and tapping the handle with a soft hammer. They're readily pulled with pliers.—*Will Thomas, Kenmore, N. Y.*



**Rocker Clamps Tapered Work.** It's very difficult to hold tapered work securely in a vise, but with the rocker shown you can even clamp round pieces firmly. It's a piece of ½" plate the width of the vise jaws, with a 90° groove on one face and a blind hole in the other. In this hole is pressed the shank of a hemispherical button, which acts as a pivot. Teeth can be cut on the clamping face. The groove, useful for holding round stock, can be omitted for flat work.—*Roger Isetts, Kenosha, Wis.*



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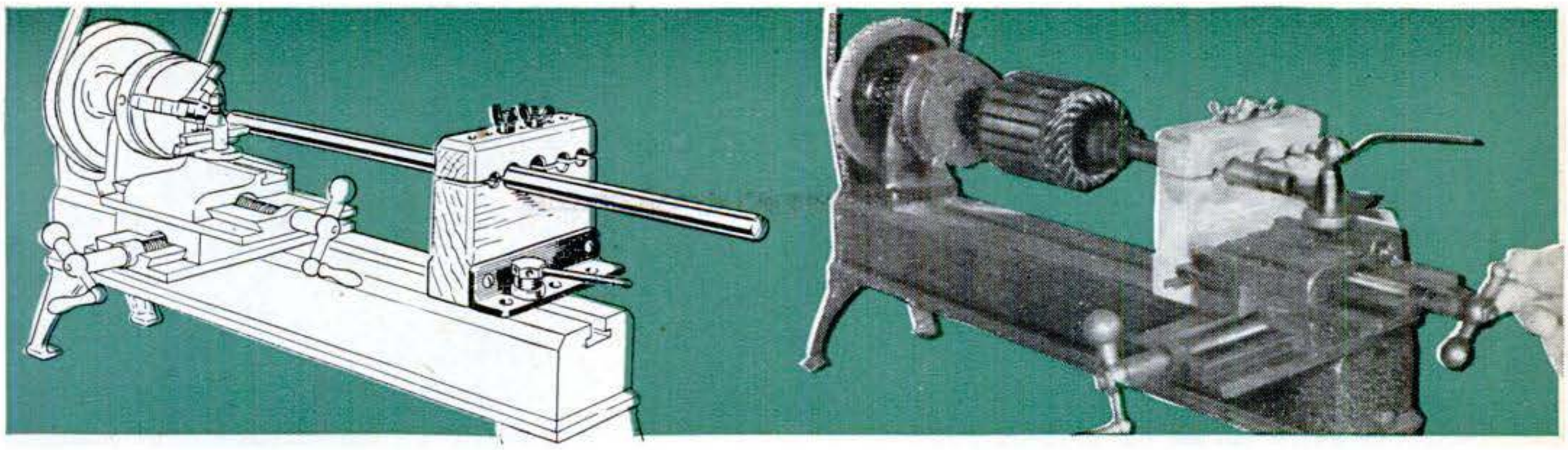
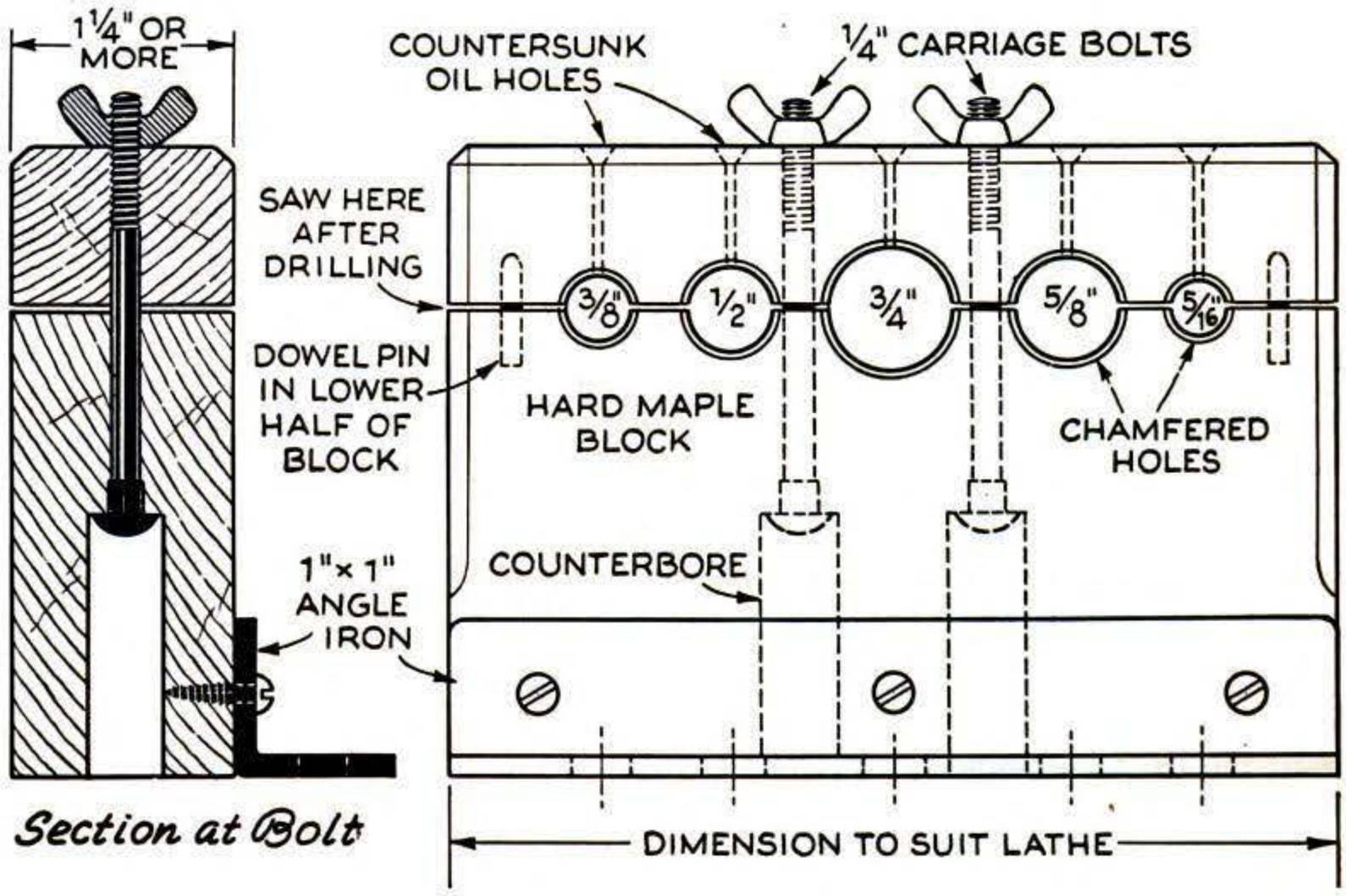
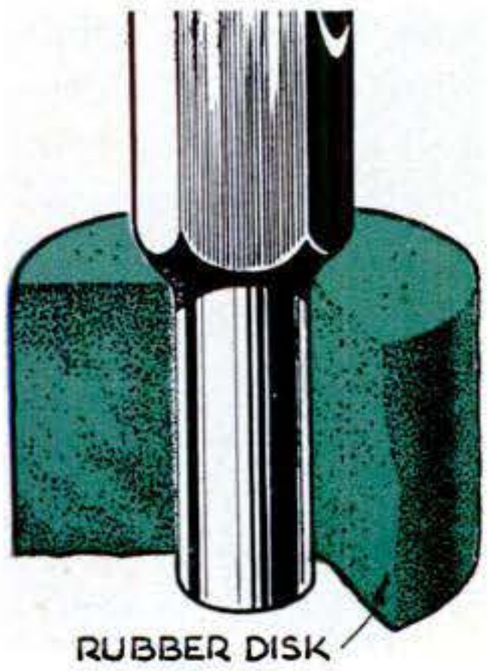
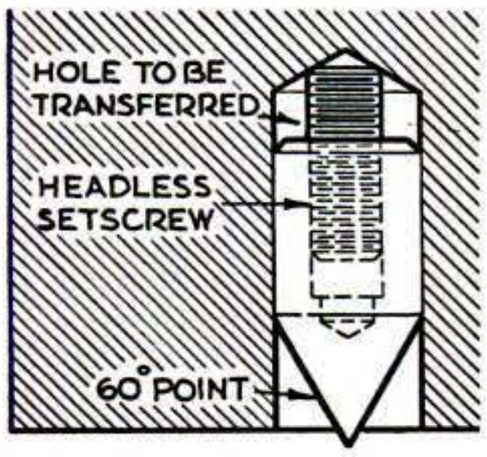


**Quickie Steady Rest.** If you have no steady rest, you can still machine light work longer than the between-centers capacity of a lathe by making a rest from hard maple as shown. Adjust the tension of the upper part of the block with the wing nuts, and oil well to prevent heating. Tension should be just enough to avoid chatter.—*R. G. Bullard, Monterey Park, Calif.*



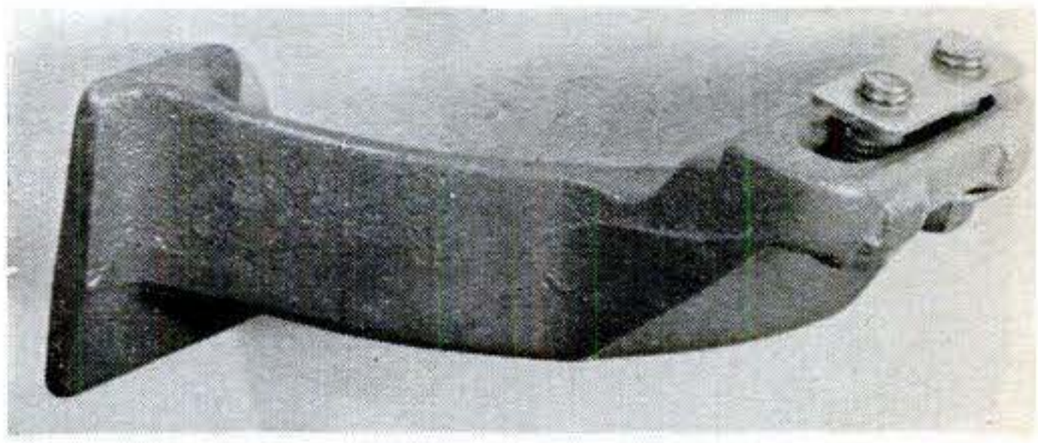

**Compression Washer Frees Punch.** In punching numerous holes by hand, it's annoying and time-consuming to work the punch free of the holes. A heavy rubber disk or a section cut from a solid rubber ball, slipped on as shown, will compress on the blow and tend to draw the punch out.—*Roger Isetts, Kenosha, Wis.*




**Spots Blind Holes.** Adjustable for holes of various depths, simple plugs like this transfer the locations of blind holes accurately. They can be made of drill rod. Tap deeply for a headless setscrew of appropriate size, turn the taper, and harden. Then grind the point. The setscrew should bottom in the hole as the point just projects.

**Double Quench Hardens Better.** Cracking or distortion of small work in the hardening process can often be prevented by proper quenching. Plunge the piece in water only an instant, and immediately quench in oil. The quenching time in water depends on the size of the part, and may range from a fraction of a second to several seconds. Quenching in oil first gives toughness rather than hardness.



**Retaining Cap Screws.** Accessories such as grinder rests, follower rests, and the like are secured when in use with cap screws. The screws won't be lost or mislaid when the piece is detached if they're secured to the accessory itself with a piece of thin metal tapped to fit, as in the photo.—*John A. Blaker, Auburn, Mass.*



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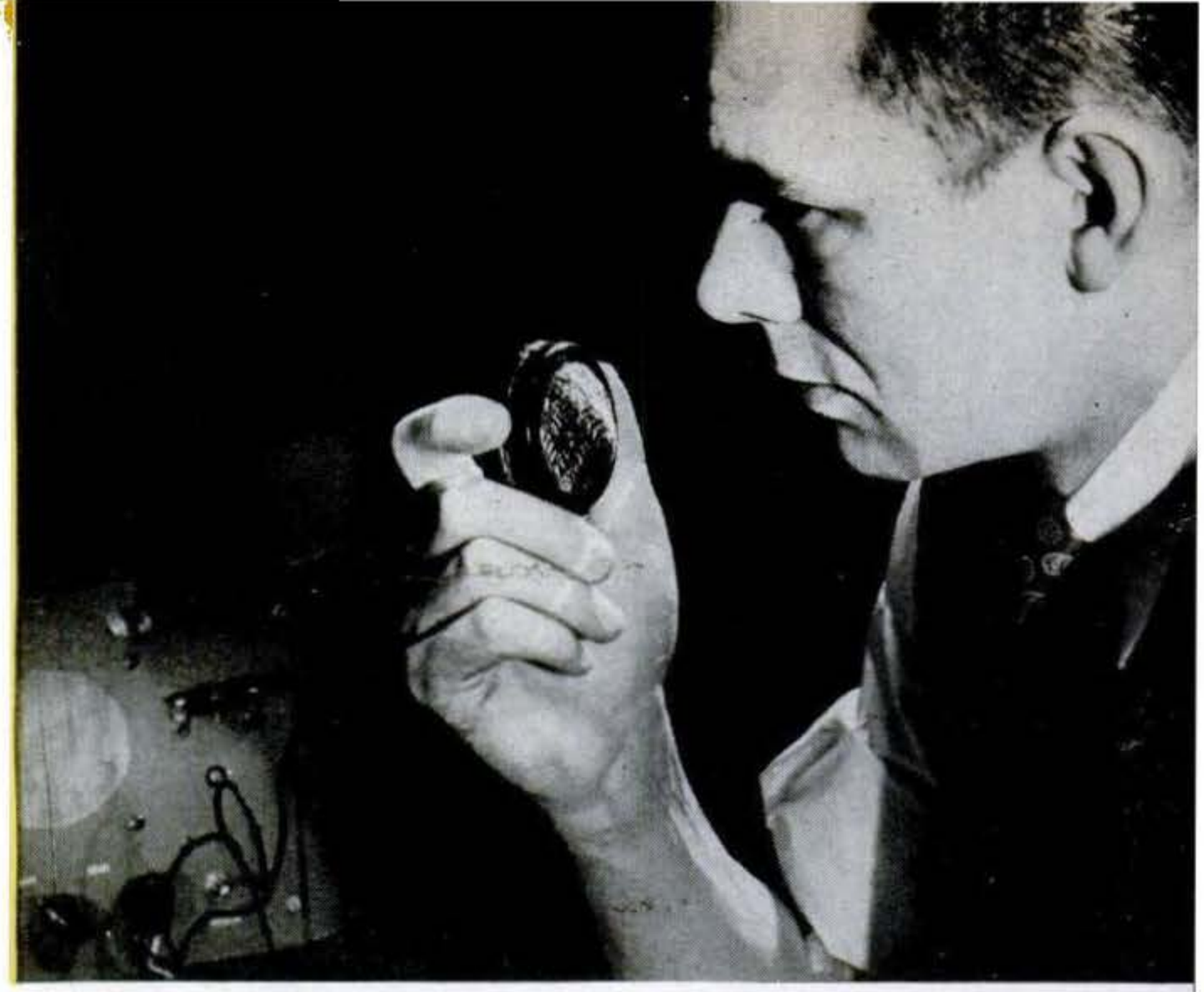
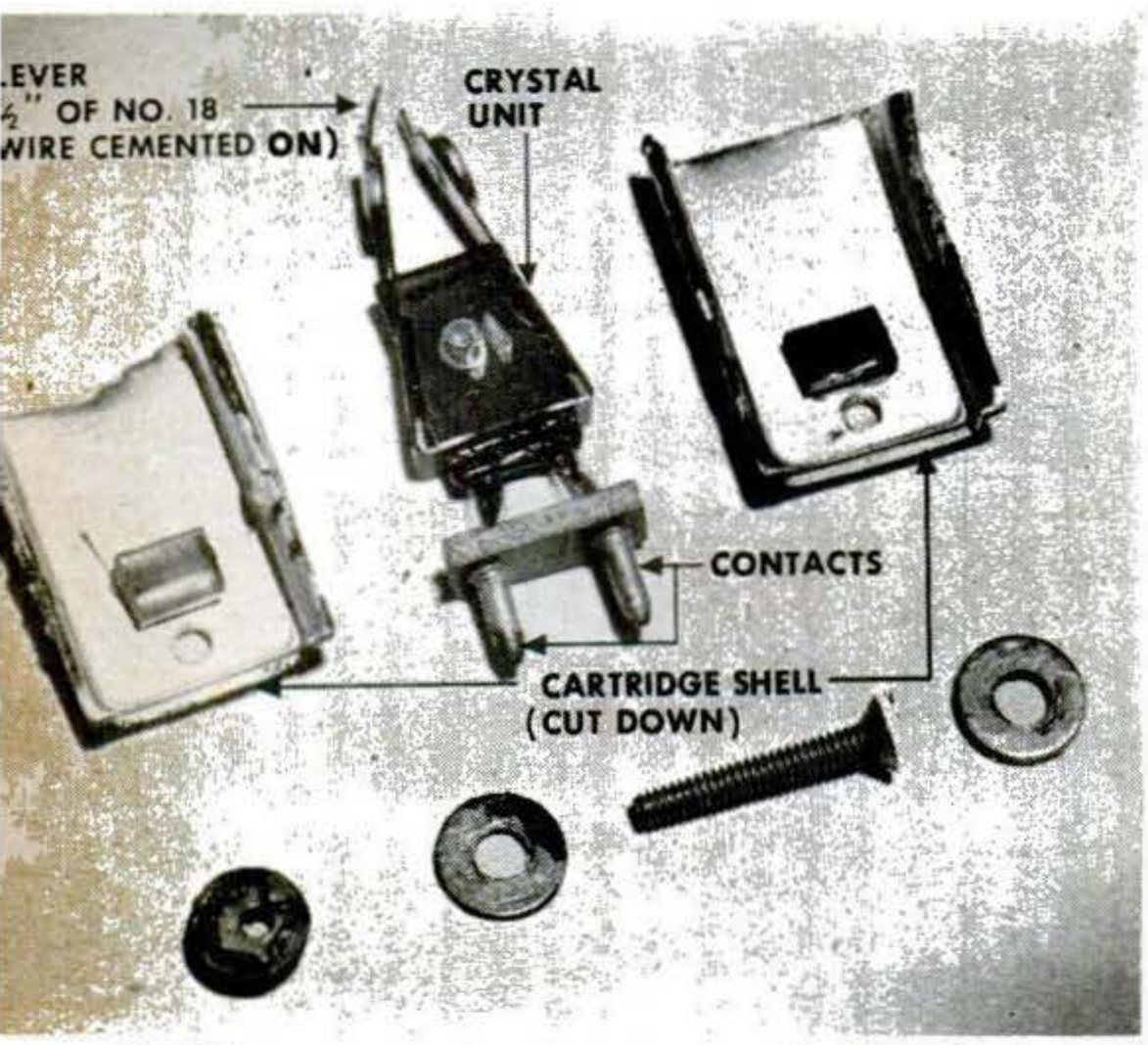
# Mike Made From Phono Cartridge






**Drilling out rivets** permits shell and crystal to be disassembled. The shell is cut down and a wire lever is cemented to the crystal.

**Cartridge is mounted** in a solder can. The foil diaphragm is cemented to lever at point of contact and pressed down around edges of can.

OLD phonograph cartridges contain the makings of pretty good microphones, as I discovered when I needed a mike for testing an amplifier and recorder.

The Rochelle-salt crystal units of both mikes and pickups do the same job of converting vibrations into volts. To make a discarded cartridge responsive to sound waves I proceeded in this way:

I drilled out the rivets holding the cartridge shell together, carefully separated the halves, removed the crystal unit, and sawed off the tops of both shell halves. To one of the fingerlike projections on the crystal unit I cemented a wire lever.

For the microphone case I used a small solder container, cutting an opening along the bottom edge to pass the connecting wires. The diaphragm is a disk of cigarette-package tin foil with the paper soaked off. It is pressed over the projecting wire lever, and cemented around the edges of the can. At the point where the lever pierces the foil I added another drop of cement. To let sound reach the diaphragm, I cut away most of the can lid and cemented a piece of loudspeaker grille cloth around the opening.

A shielded single-conductor wire connects the mike to the input of an amplifier. The center wire goes to one lug on the cartridge and the shield to the other. I also soldered a connection from the shield to a bare spot on the can. As a final touch I coated the outside metal with black lacquer.

Output of this microphone is somewhat higher than most commercial jobs. I haven't tested it for sensitivity or frequency range, but on several amplifiers and recorders it passed the ear test with flying colors.—*Norman J. Pederson, Seattle, Wash.*



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# What You Can Do With New Kinds of Glue

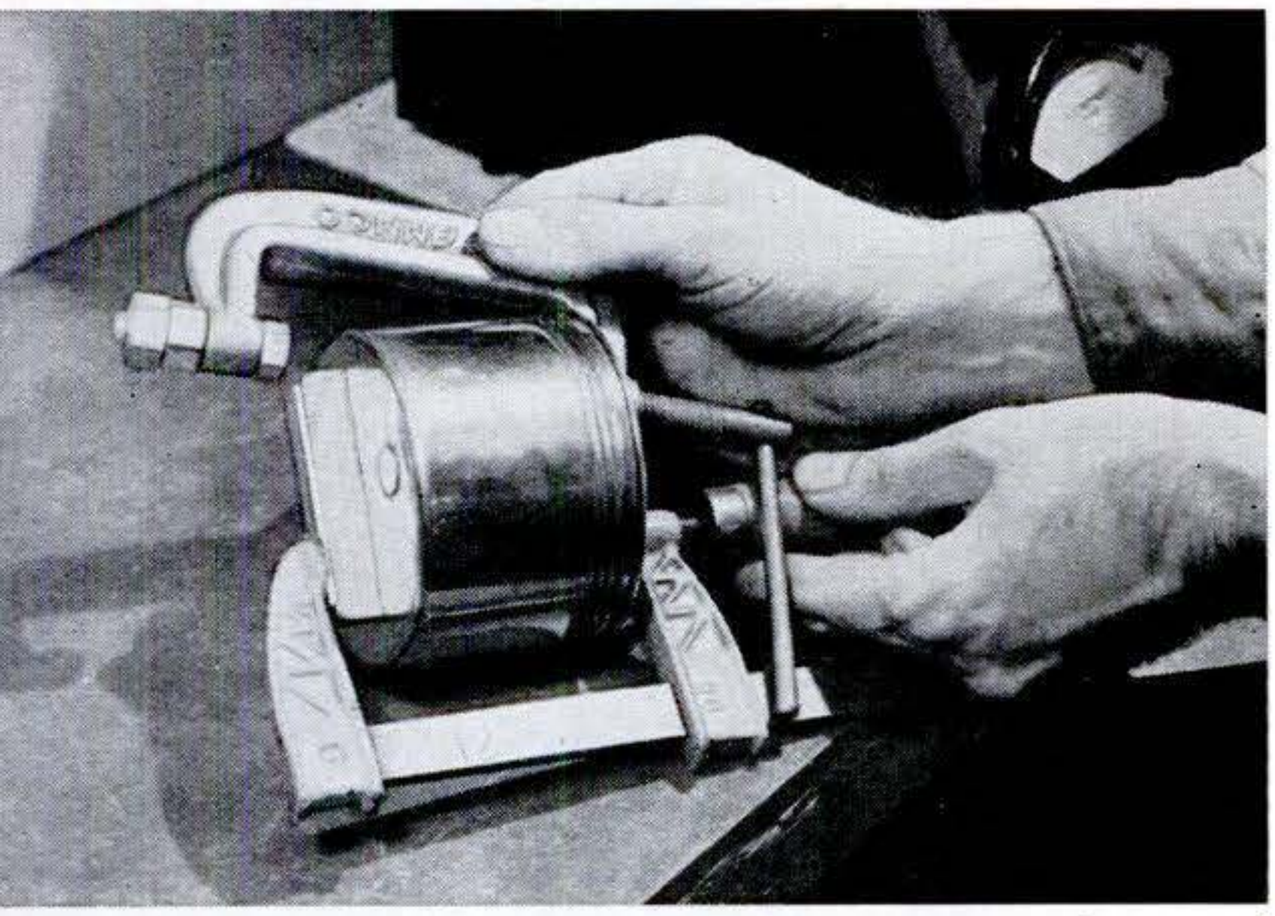
THE days of heating up a smelly glue-pot are gone. Now when you want to glue up anything from wood and glass to steel and asbestos, all you do is open a jar or can of one of the new adhesives.

Pliobond®, made by the Goodyear Tire and Rubber Company, bonds a variety of materials—wood, paper, fabric, metal, leather, glass, and ceramics. The adhesive has a high resistance to water. Heating the joint will cut down the setting time.

Woodgrip®, Magigrip®, and Stix® are all made by the Adhesive Products Corp., of New York City. Woodgrip is a milky-white liquid used to glue wood to itself or to glass, metal, tile, and painted surfaces. After the glue is applied and the parts clamped for 20 minutes, the joint may be sanded or machined.

Magigrip—used on glass, rubber, stone, and fabric, among other things—requires no heat or pressure to set the bond. It is simply brushed on one surface and the joint assembled—immediately if one or both surfaces are porous, or after drying 10 to 15 minutes if both surfaces are nonporous. This adhesive is also suitable for attaching soap dishes, towel racks, and similar fixtures to tile walls.

Stix is a waterproof cement said to be especially suitable for gluing plastic sheet material to the tops of tables and counters or work surfaces. Clamping is not essential. Stix also glues asbestos to steel, leather to metal, abrasive cloth or paper to rubber, plaster to plaster, and plastic to plaster.—*Walter E. Burton, Akron, Ohio.*



**You can glue a wooden handle** to the metal cap of a vacuum bottle with Pliobond. The handle will make it easier to unscrew the cap.

**You can repair a small wooden box** with Woodgrip. Maximum strength develops in 24 hours. Heating it up to 180° F. speeds setting.

**You can make smoothing sticks** by putting sandpaper on wooden handles with Magigrip. Adhesive also serves as cushioning.

**You can make kitchen hot-plate** holders by cementing disks of laminated plastic to circular pieces of ½" insulating board with Stix.

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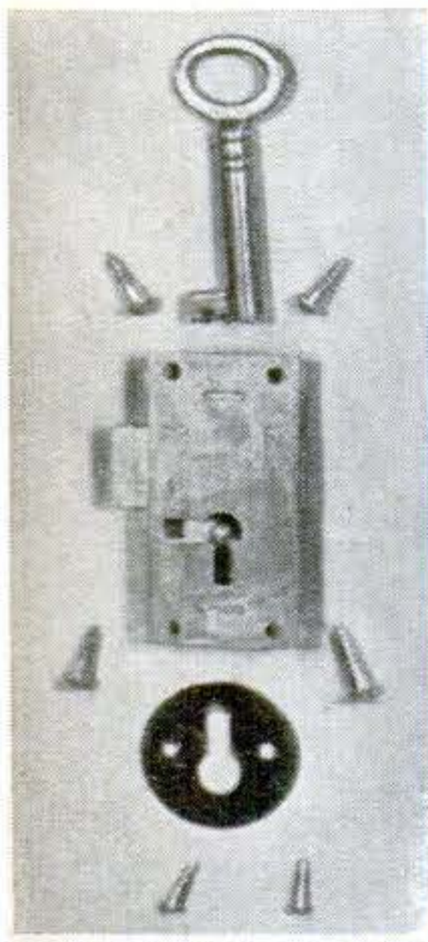
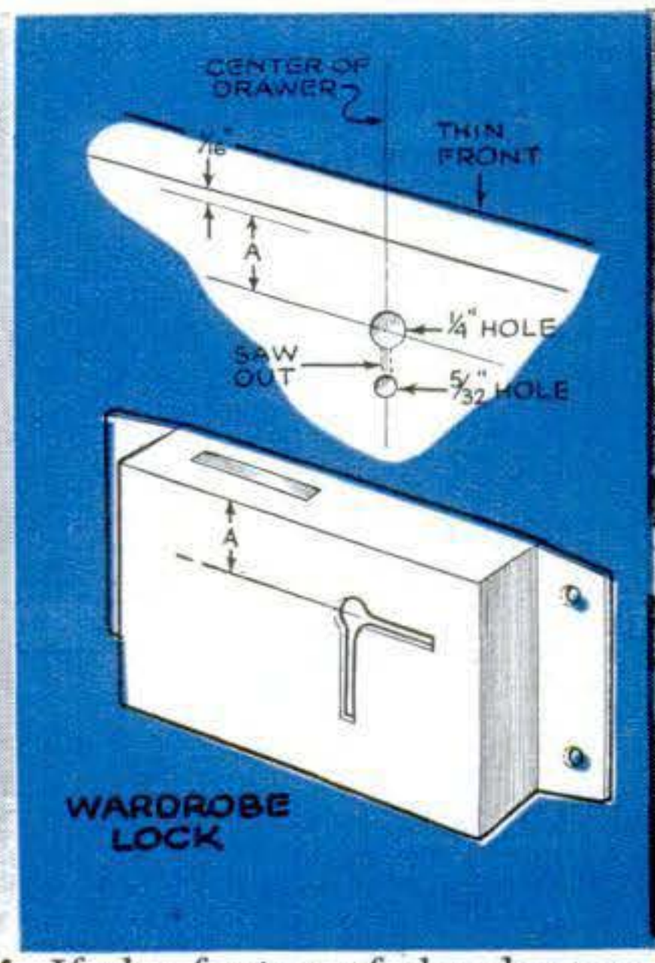
# Add a Lock the Easy Way

Is THERE a drawer in your house that you'd like to keep locked? Putting a lock on is likely to be easy—if you choose the right kind. Regular drawer locks require considerable chiseling. But the chances are you can avoid that work by choosing a wardrobe lock (costing only about 35 cents) or a cupboard lock (about 65 cents). These pictures show you how each type is installed.

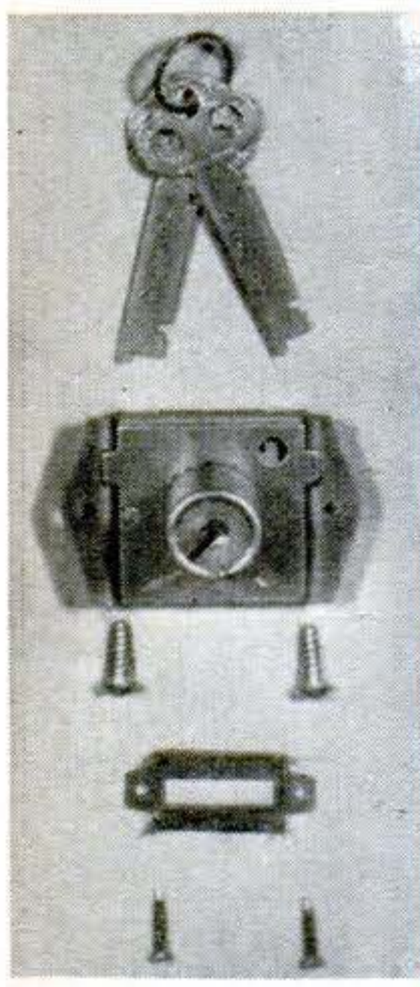


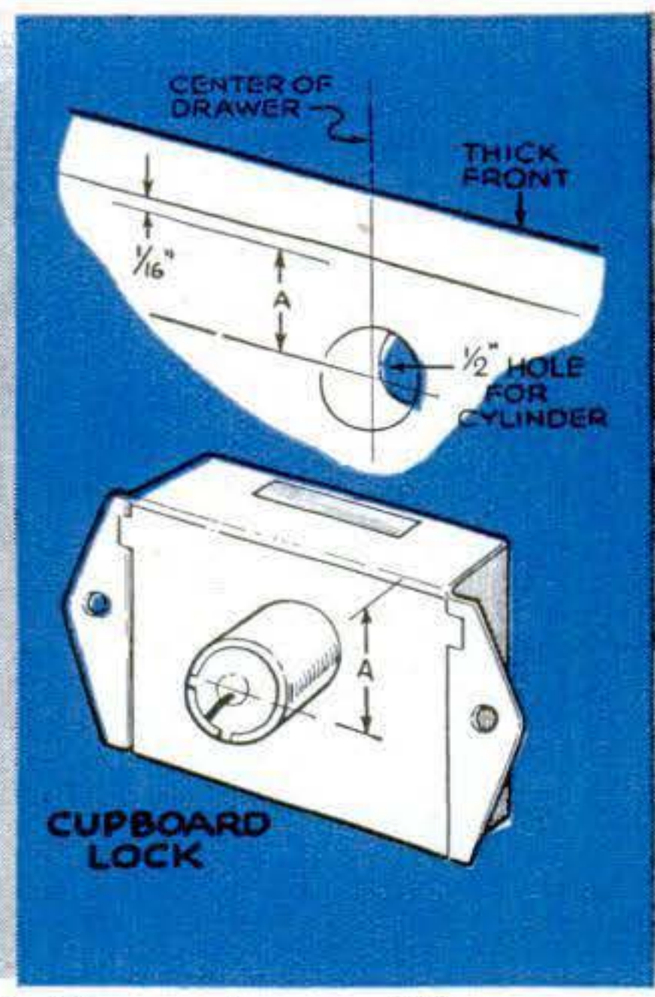


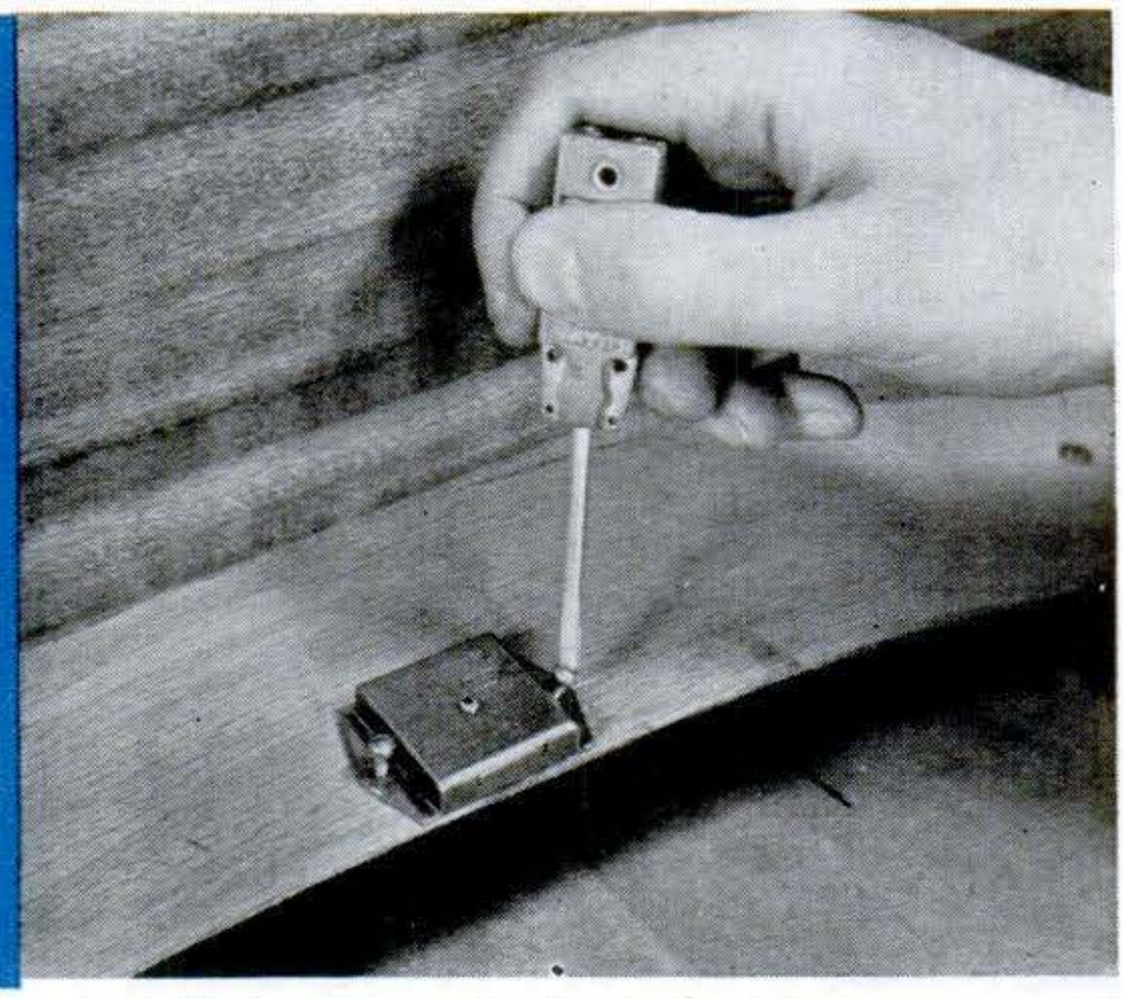
**WARDROBE LOCK** If the facing of the drawer you want to lock is not more than ½" thick, you can use a wardrobe lock, which is about 1" high by 2" wide by ¼" deep. The only thing you have to do to the facing to put on this kind of lock is cut out a small opening for the key.

To do this, find the center of the drawer, measure the distance A (see sketch above), and leave about 1/16" between the top of the lock and the top of the drawer. Then drill two holes in the drawer facing, and cut out the wood between them with a coping saw to make an opening the shape of a keyhole. The top hole should be about ¼" in diameter and the lower one smaller. The lock can then be screwed in place to the back of the drawer facing, and—if you like—an escutcheon plate (purchased separately for 6 or 7 cents) can be placed over the keyhole.

You can cut the groove in the rail to receive the bolt with a small chisel or a gouge such as model-makers use. A small ball cutter does fine. A plate slotted for the bolt is optional.





**CUPBOARD LOCK** For a drawer ¾" or more thick, a cupboard lock is better. This kind of a lock is not suitable for wood less than ½" thick, but is even simpler to install than a wardrobe lock. Choose one with a lock cylinder as long as your drawer's facing is thick. Then measure the distance A (see sketch above) and drill for the cylinder.



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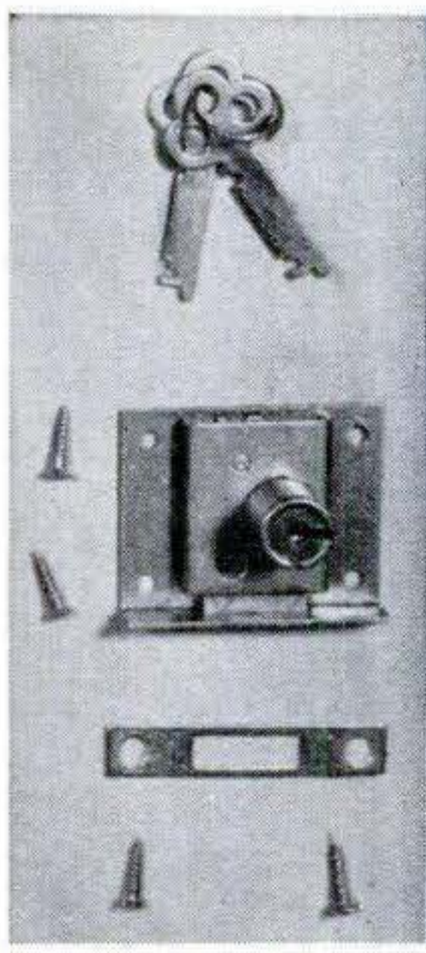

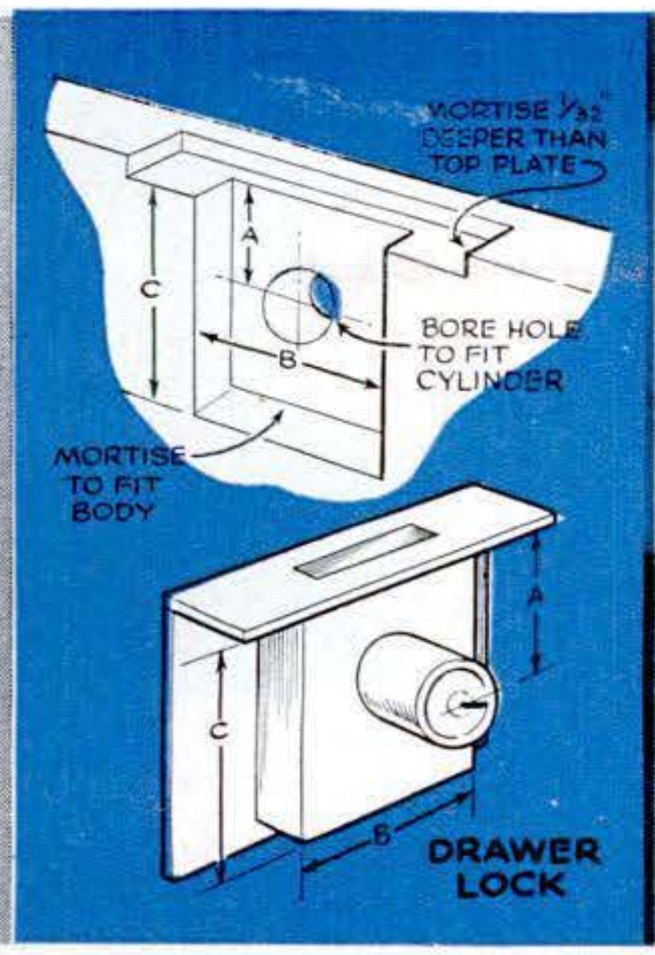


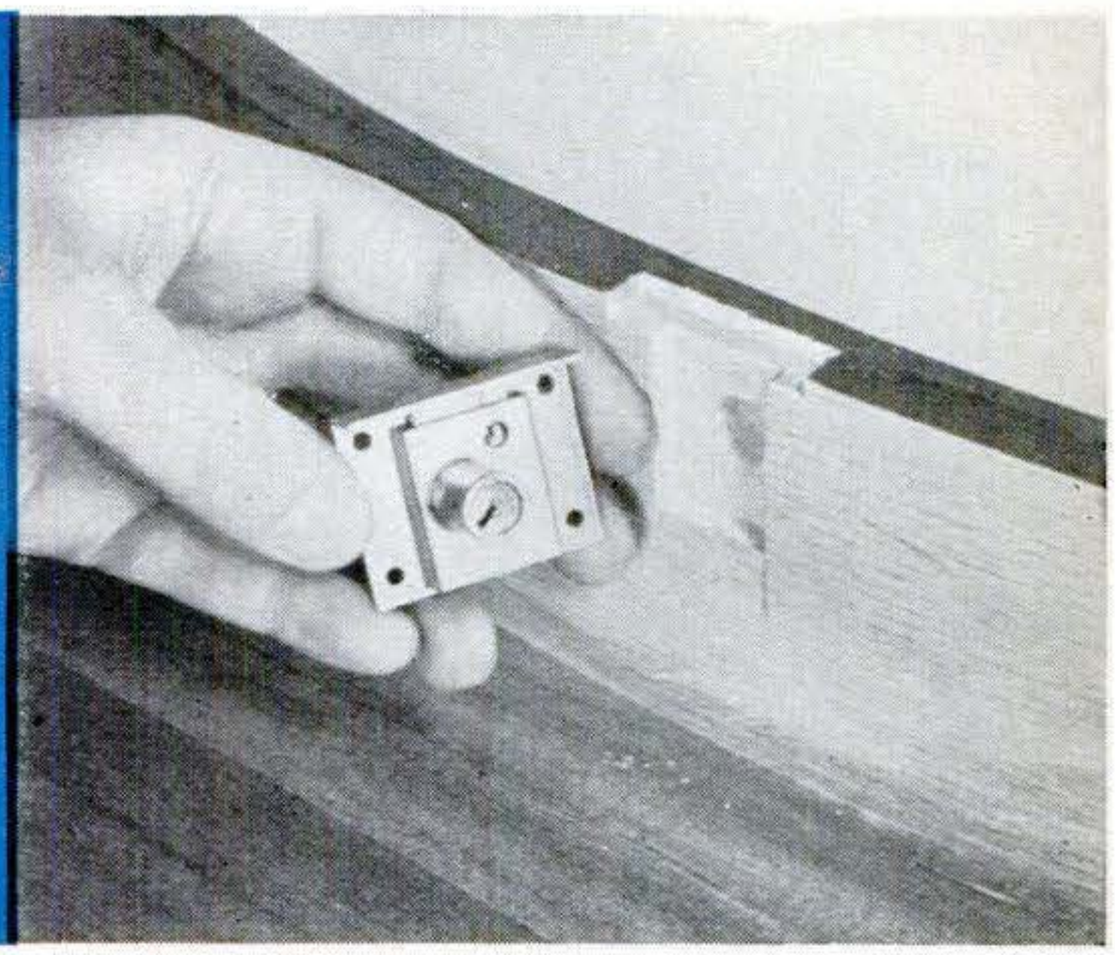

**DRAWER LOCK** Installing a drawer lock entails more work than putting on a wardrobe or cupboard lock. First, measure the distance A, allowing for the top plate to be recessed about 1/32". Then drill a hole equal to the lock cylinder's diameter. Next measure B and C and chisel out the wood the required amounts. The work will go faster if you first make a series of small cuts in the wood with a pistol-grip hacksaw.

## Making a Photo Light Stand

Most old floor or bridge lamps can be converted into stands to support photo lights. Remove the socket and all fancy work. You will then have a sturdy base with, probably, a ¼" pipe thread at the top of the upright. To this attach a 24" gooseneck by means of a ¼" to ⅛" adapter coupling. The addition of a socket, wiring, and reflector complete the job. If you use photoflood lamps, be sure the wiring and socket are suited to the current and heat involved. A coat of black paint will improve the looks of the finished stand. —*Herbert Pfister, The Bronx, New York.*

## Cloth Strip Seals Roof Crack

In roll roofing, leak cracks can't be permanently closed by roof cement alone, for expansion and contraction of the material will eventually open the break again. For a lasting repair, cement a 1" strip of strong cloth along the crack, smooth it down, and coat the surface with cement.

## Glue Wood When It's Dry

While doing a gluing job, be sure the wood isn't wet. If it is, it won't absorb water from the glue. The glue will then not set properly and the joint will be weak.

## TEMPERING

| Temp. range in deg. F. | Color of oxide film | Type of tools |
|---|---|---|
| 437 to 455 | Light straw to straw | Scrapers for brass, steel-engraving tools, light turning tools, hammer faces, planer tools for steel, planer tools for iron, wood-engraving tools, drills, milling cutters |
| 456 to 482 | Dark straw to yellow-brown | Wire-drawing plates, boring cutters, screw-cutting dies, taps, rock drills, mill chisels and picks, punches and dies, reamers, shear blades, half-round bits, planer knives and molding cutters (to be ground), gouges, plane irons |
| 483 to 527 | Yellow-brown to dark purple | Twist drills, flat drills, wood-boring cutters, drifts, cup tools, edging cutters |
| 528 to 572 | Dark purple to full blue | Wood bits and augers, cold chisels for steel, axes and adzes, gimlets, cold chisels for cast iron, needles, wood chisels, hack saws, cold chisels for wrought iron, planer knives and molding cutters (to be filed), circular saws for metal, screw drivers, springs, saws for wood. |

Note: The tools are arranged approximately in their order on the color scale.

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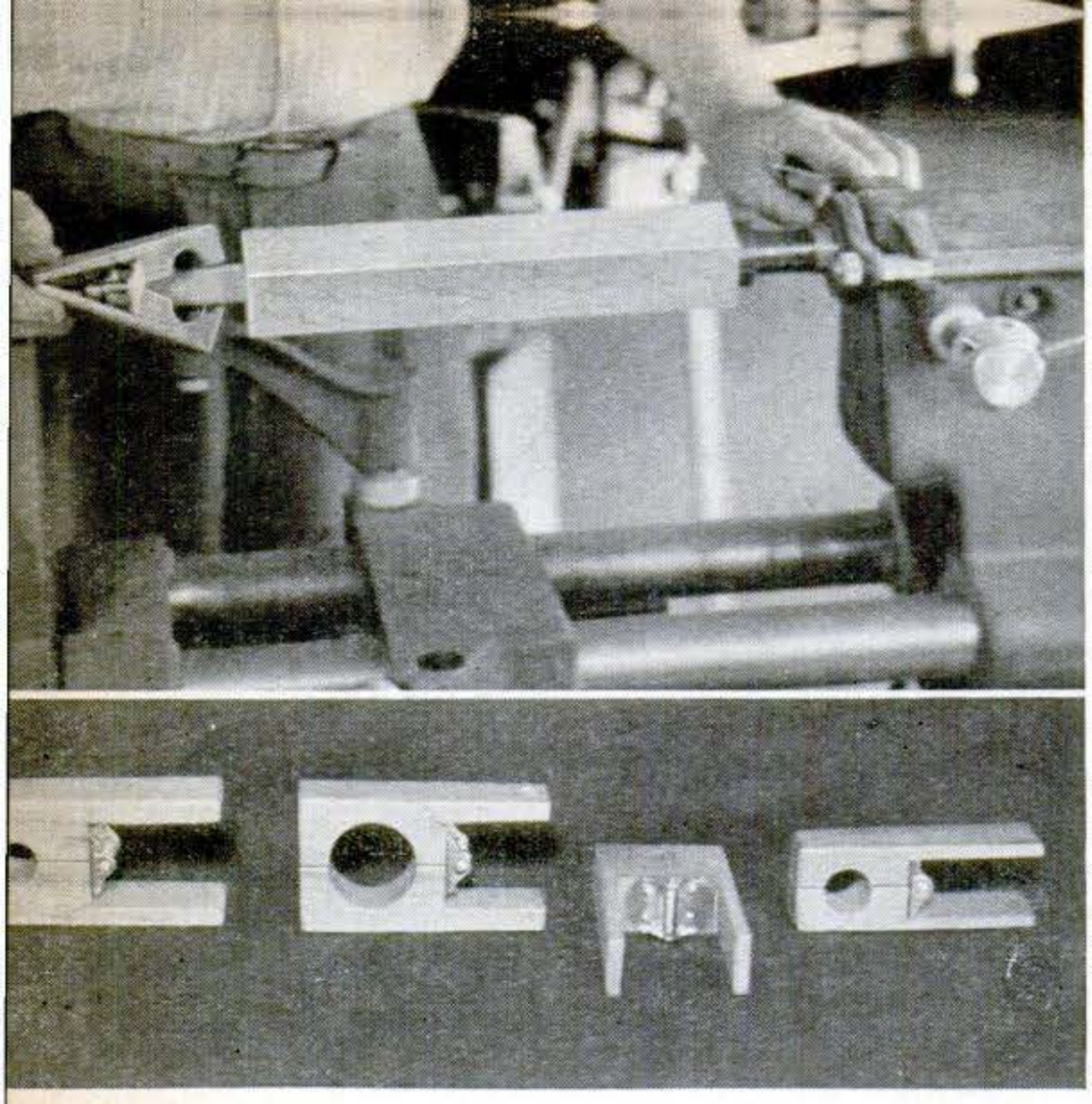
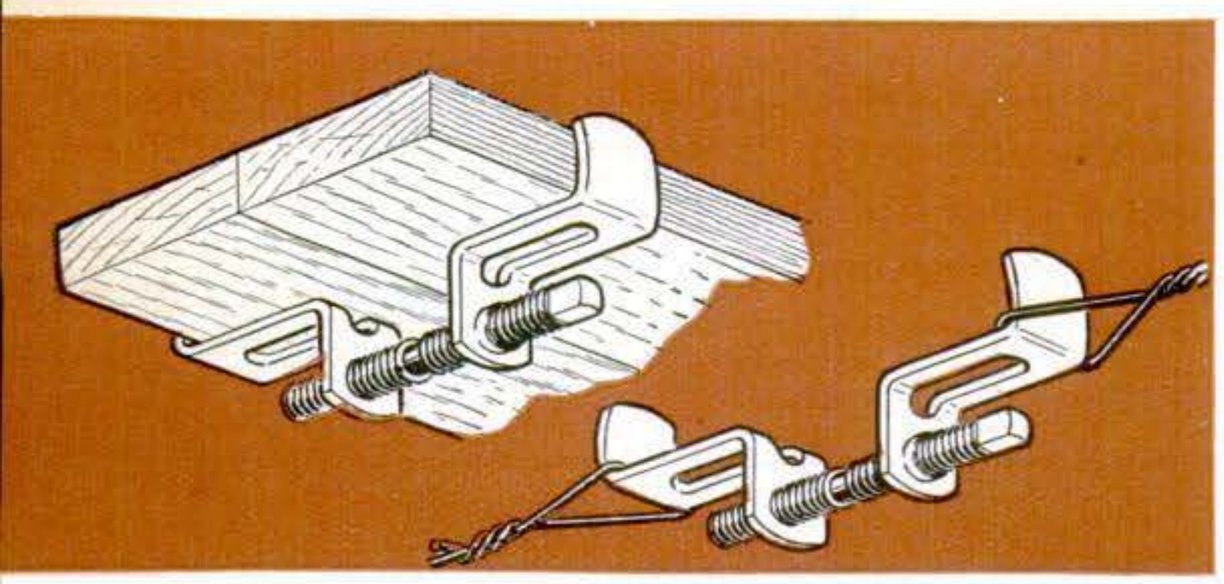


## Wood Calipers for Lathe Use

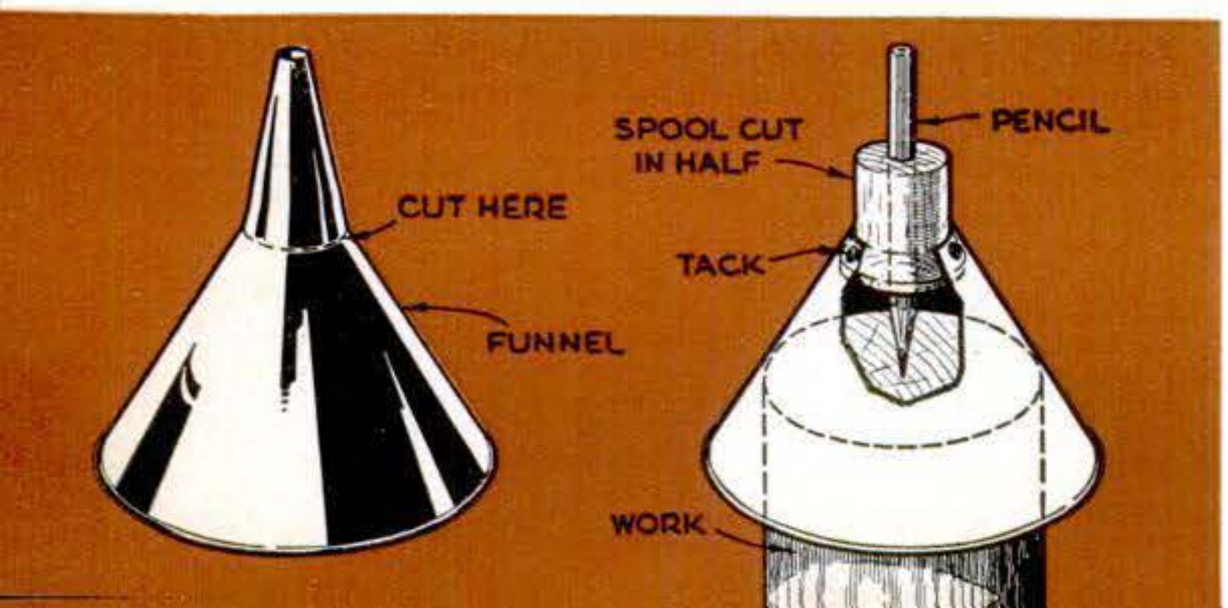
WITH a set of the homemade calipers shown above, you can turn lathe work to fit pre-drilled holes without the bother of removing it for a trial fitting.

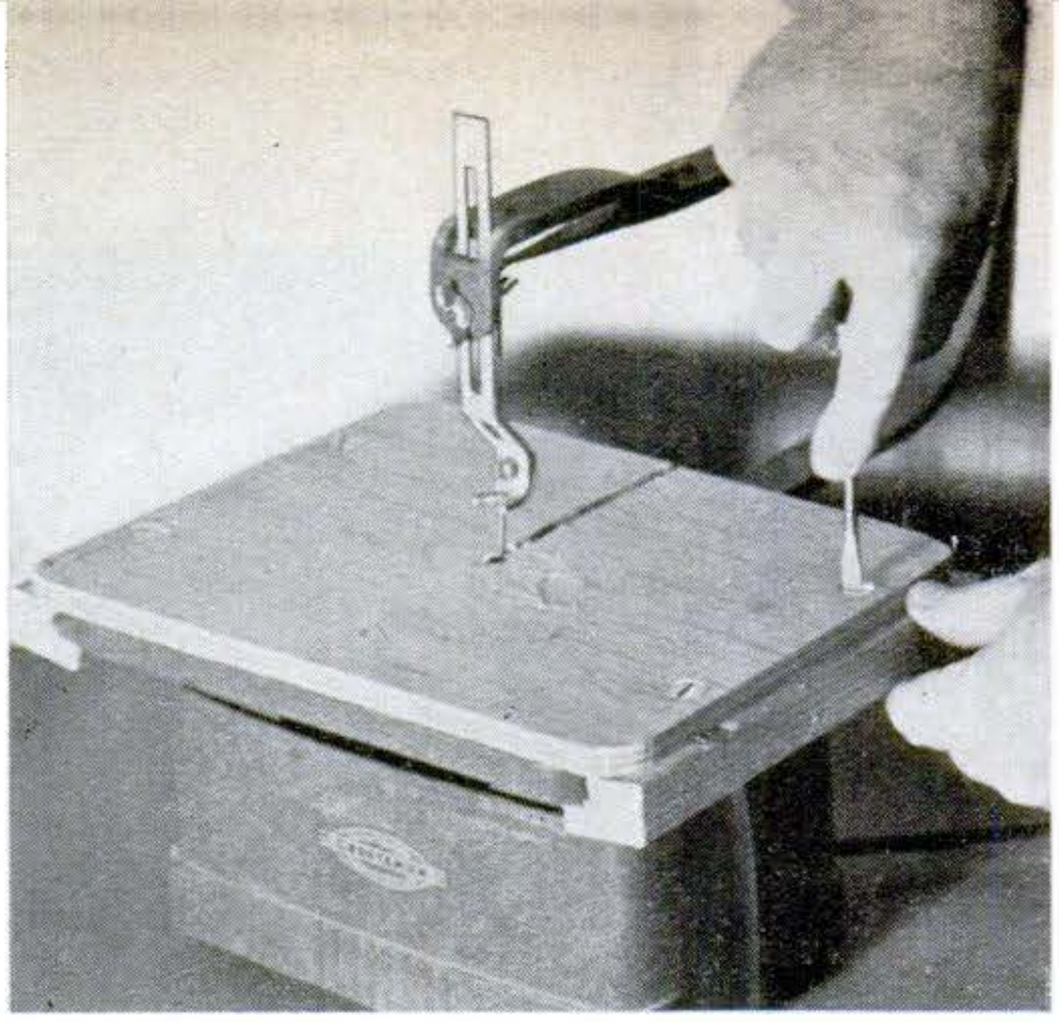
Make one for each common bit size. Use 4″ lengths of 1¼″ hardwood about ¾″ wider than the bit diameter. Rip the piece through the center and plane the cut edges. Clamp the pieces together, drill the hole about ⅜″ from one end, and saw out a wide slot in the other end. Join the pieces with a spring hinge.—*W. G. Waggoner, Sacramento, Calif.*



## Funnel Device Locates Center

WITH the marker shown below, it is easy to locate the center of round work for mounting in a wood lathe. Cut off the bottom of the funnel and fit in half of a spool so a round pencil will be parallel to the funnel axis. In using the marker, be sure the end of the work is square and that the funnel rests true on the work.



## Table Pads Save Saw Blade

IF YOU cut only thin stock with a short-stroke magnetic jigsaw, the upper part of a blade will still be sharp when the working area has dulled. To get full value from each blade, I bolt on false table tops to raise the work to the sharp area.

With each new blade, I first use just the metal table. Then I add a false top cut from ⅜″ plywood. Later I take this off and put on another ¾″ thick. Finally, I use both tops together. This enables me to make use of 1⅛″ of the blade.

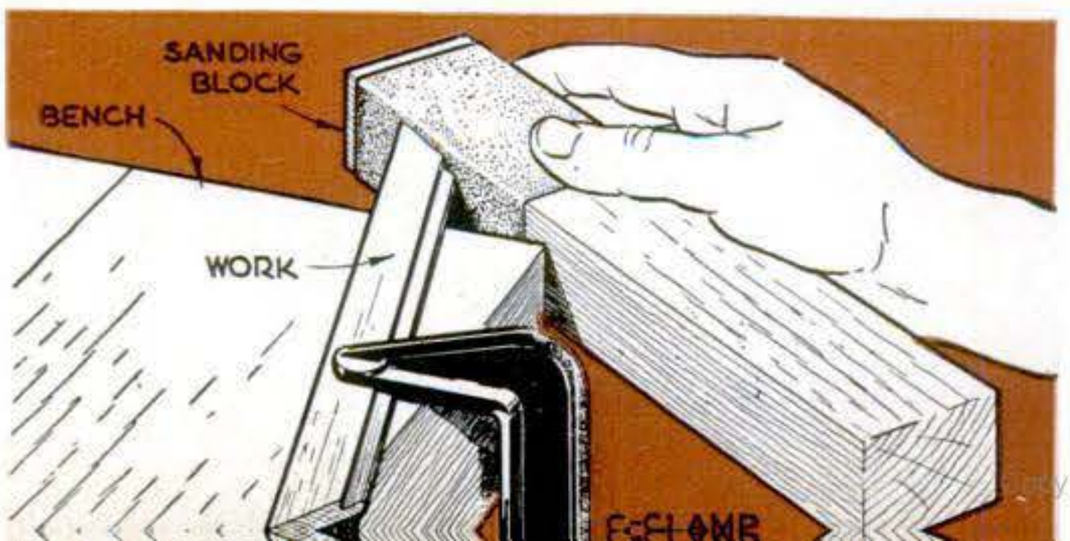
Flathead bolts through rabbeted cleats clamp the assembly to the metal table.—*John A. Moore, Ruston, La.*

## Skate Clamps Useful in Shop

TOE CLAMPS from a pair of roller skates can often be used as emergency turnbuckles or for edge-clamping small work, as at the left. Easily removed from the skates, the clamps can be used for the job and then returned to serve their regular function. In clamping, the jaw limit is about 4″.—*W. F. Dierken, Dayton, Ohio.*

## How to Sand a Bevel Flat

IN SANDING a bevel cut by hand, it is difficult to keep the sanding block from rocking and spoiling the flat surface. To avoid this, use a sanding block longer than the paper and place the tail against the corner of the workbench. Hold the beveled piece firmly on the bench so the bevel is flat against the sandpaper. Sand with short strokes.—*O. B. Ritchey, Lake City, Mich.*

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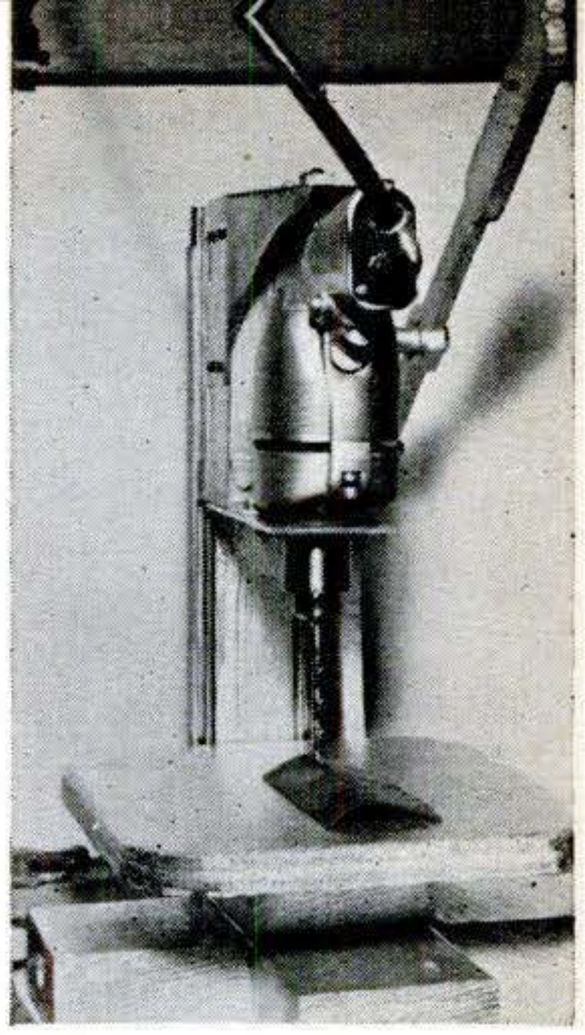
# Holes Go Straight with This Drill Mount



WITH a stand like this, you can add many of the advantages of a drill press to your electric drill. When you release the feed handle, a screen-door spring behind the upright raises the drill from the work.

Two pieces of trailer awning rail serve as ways for slides made of ⅜″ rod. Awning rail can be bought for about 25 cents a foot. Screw two lengths to each side of the upright, allowing the open edge to project.

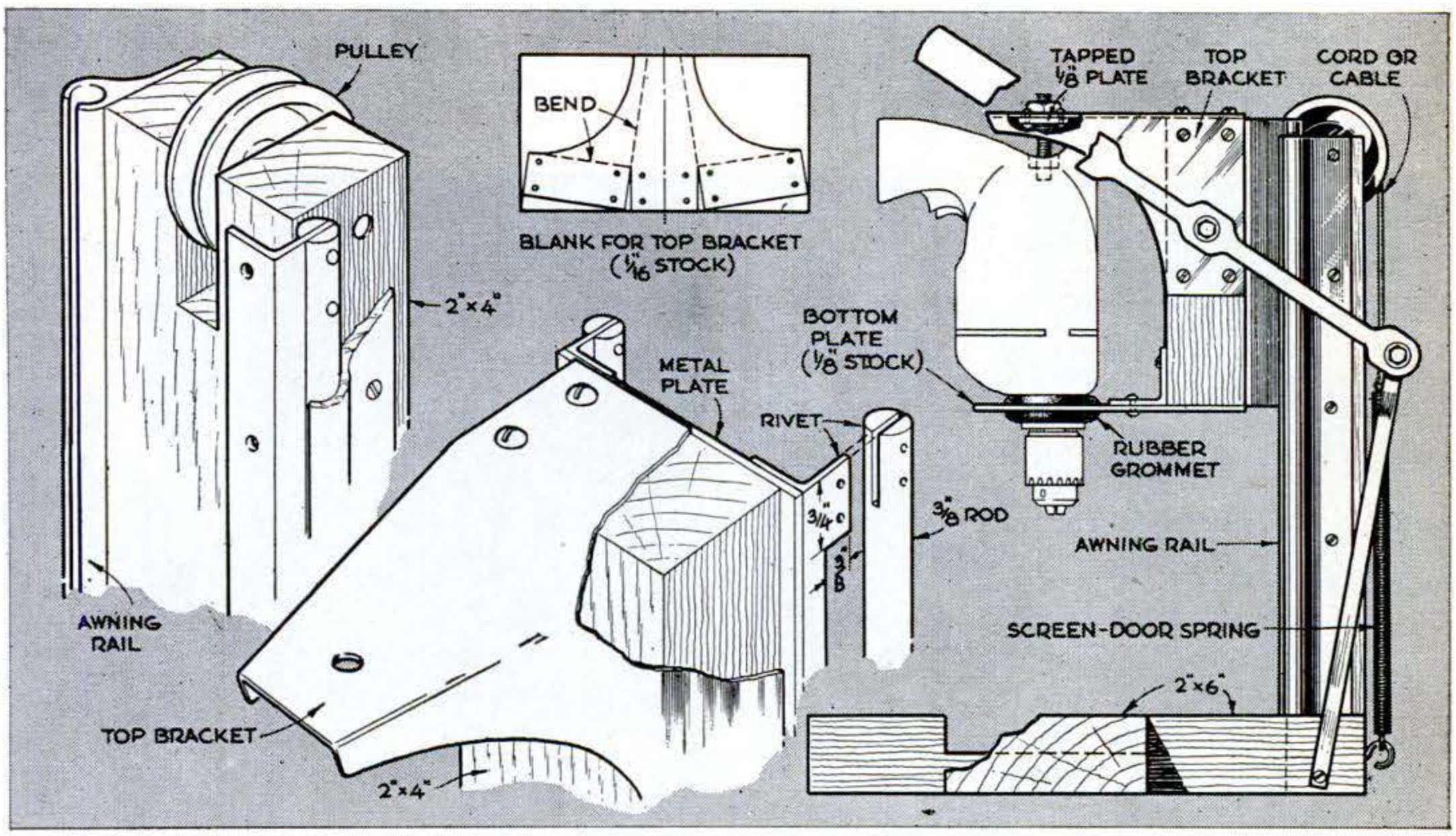
Usually the rail bore is a bit less than ⅜″. To get an easy sliding fit, take a ⅜″ rod, chuck it in your drill and, with emery cloth, smooth it down slightly. If the chuck has a ¼″ limit, you can do the trick by chucking a ¼″ stub and then slipping a small rubber hose over the stub and the end of the ⅜″ rod. Also smooth out the inside of the rail with emery cloth rolled around a ¼″ rod.

When you have a good fit, cut the rod into two pieces, each 6″ long, and cut a slot ¾″ deep in the ends. Then cut two pieces of angle stock to equal the rods in length. Cut away part of one side of each angle, leaving ⅜″ by ¾″ tabs at the ends to fit into the rod slots. Rivet the angles to the rods and file the rivets smooth.

Place these assemblies into the rails. Then tie the angles together with a piece of sheet metal, securely bolted. Mount a wood block on this as a spacer.

Cut the bottom support plate from ⅛″ sheet and attach it securely to the spacer block with screws and angles. Heavy sheet aluminum can be used for the top bracket.

For proper operation of the drill, it is important to align the spindle and slide exactly. To do this, first drill an oversize hole in the top bracket. Then tap a square of ⅛″ plate for a 5/16″ carriage bolt. Put the bolt down through the oversize hole, turn up the tapped plate, attach the drill, and adjust the plate until the drill bit travels straight (if your drill doesn't have a tapped hole at back, drill a small dimple there). Then rivet on the plate.—*Harry Louden, Bellflower, Calif.*



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# How to Photograph Your Shopwork

**It's not as easy as snapping the kids at the beach, but with a little know-how you can take pictures like these.**

**By Harry Walton**
*PS Photos by W. W. Morris*

SHOWING off your shop is part of the fun of having one. Maybe you've already tried taking pictures of it, armed with the family Brownie, fistful of film and flood lamps, and optimism. If the results soured you, don't give up just yet. Taking good shop photos is altogether different from snapping Aunt Mamie and the kids.

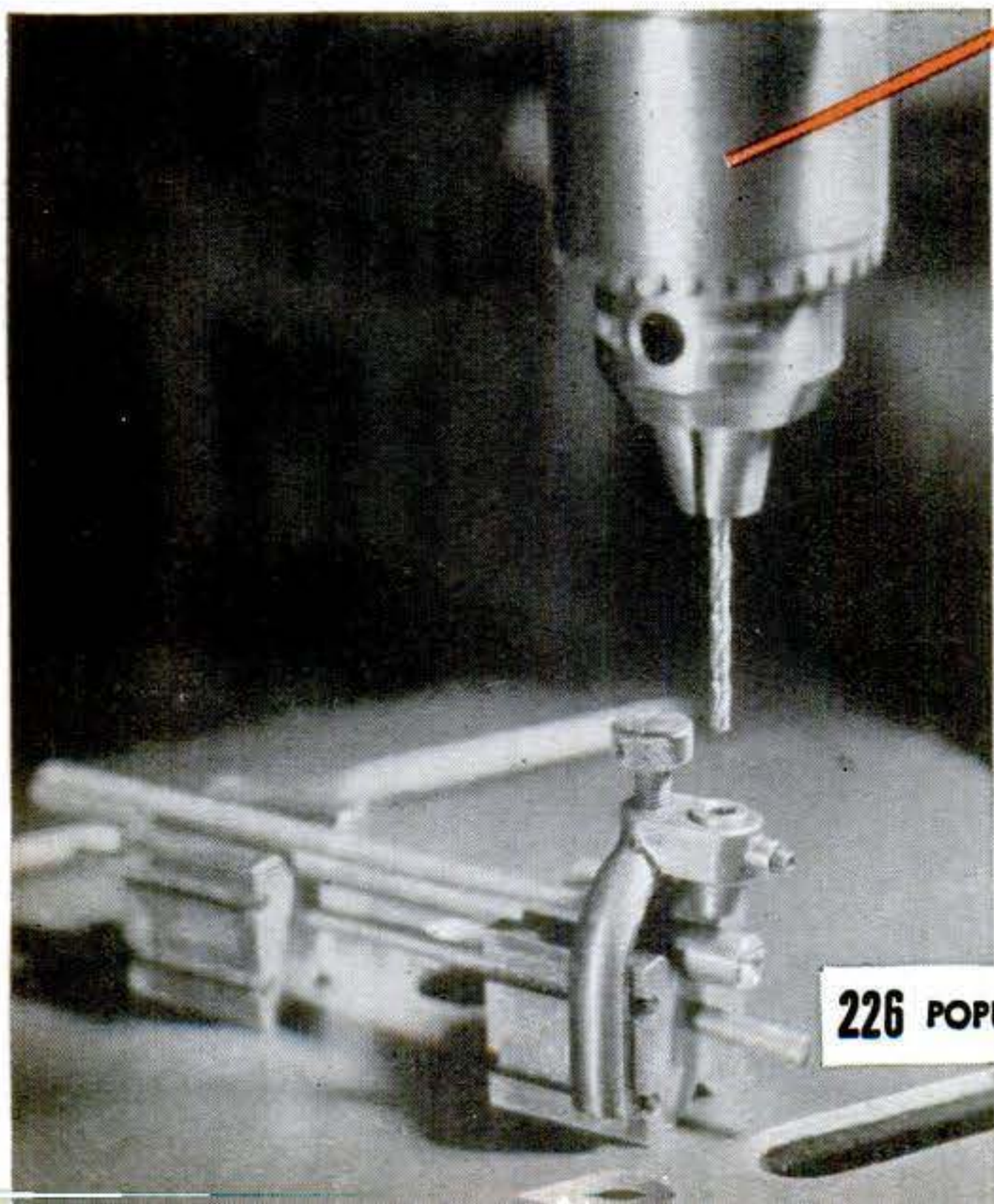
To show how it's done, POPULAR SCIENCE staff photographer W. W. Morris visited two home workshops. The photos on these pages show both the pictures taken and the setups used to get them.

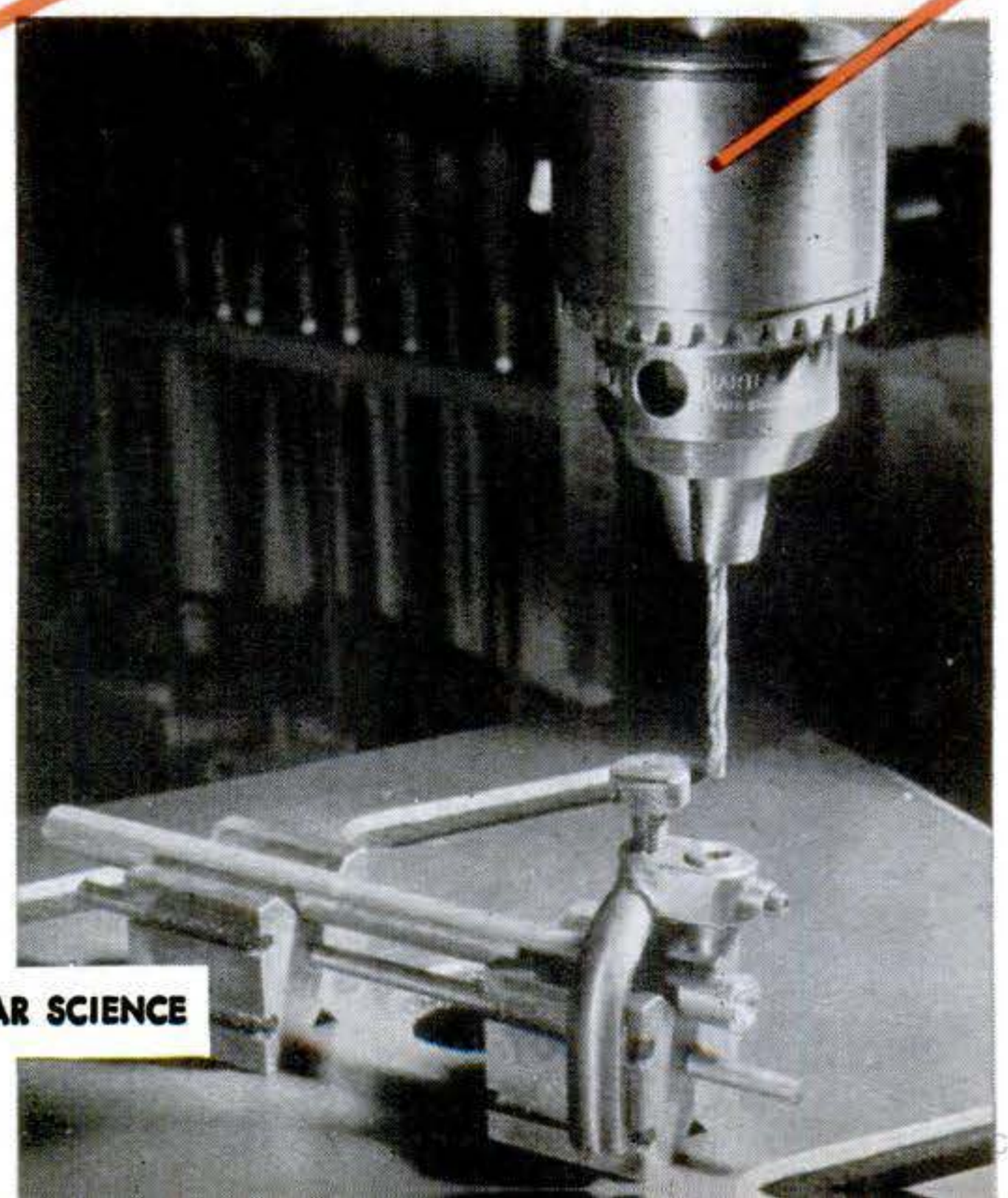
***Camera.*** Although exceptions can be found, it's safe to say that good pictures are most likely with a focusing-back camera. Runners-up may be the reflex or twin-lens reflex, but these usually require auxiliary lenses to focus at less than three feet. Also, most twin-lens cameras introduce parallax, which means you may see things in the finder that are not on the film. A focusing-back (ground-glass) camera lets you look right through the lens, and so can't lie. With double-extension bellows, such a camera can get you on top of your subject. Film size isn't so important; a sharp 2¼″ by 3¼″ is better than an out-of-focus 5″ by 7″ negative, and of course the film is cheaper.

If you have a fairly good camera of another type, you may want to see what you can do with it. Auxiliary portrait and copying lenses will enable you to close in on the subject. You'll have to measure—not guess—at the lens-to-subject distance. At close range you may want to tape a piece of tracing tissue at the back of the camera where the film normally lies, and compare what appears on it with what the finder shows.

Besides the camera, you need a tripod, a cable release, and a sunshade. Most shots

**Exactly the same focus** was used for both these shots, but the one at the left was shot at f/5.6, 1/50th second. Shallow depth of field leaves only the front V block and its yoke sharp. Diaphragm was stopped down to f/45 for the 1-second shot at the right. The entire work setup and drill chuck are sharp, and even the background begins to emerge.







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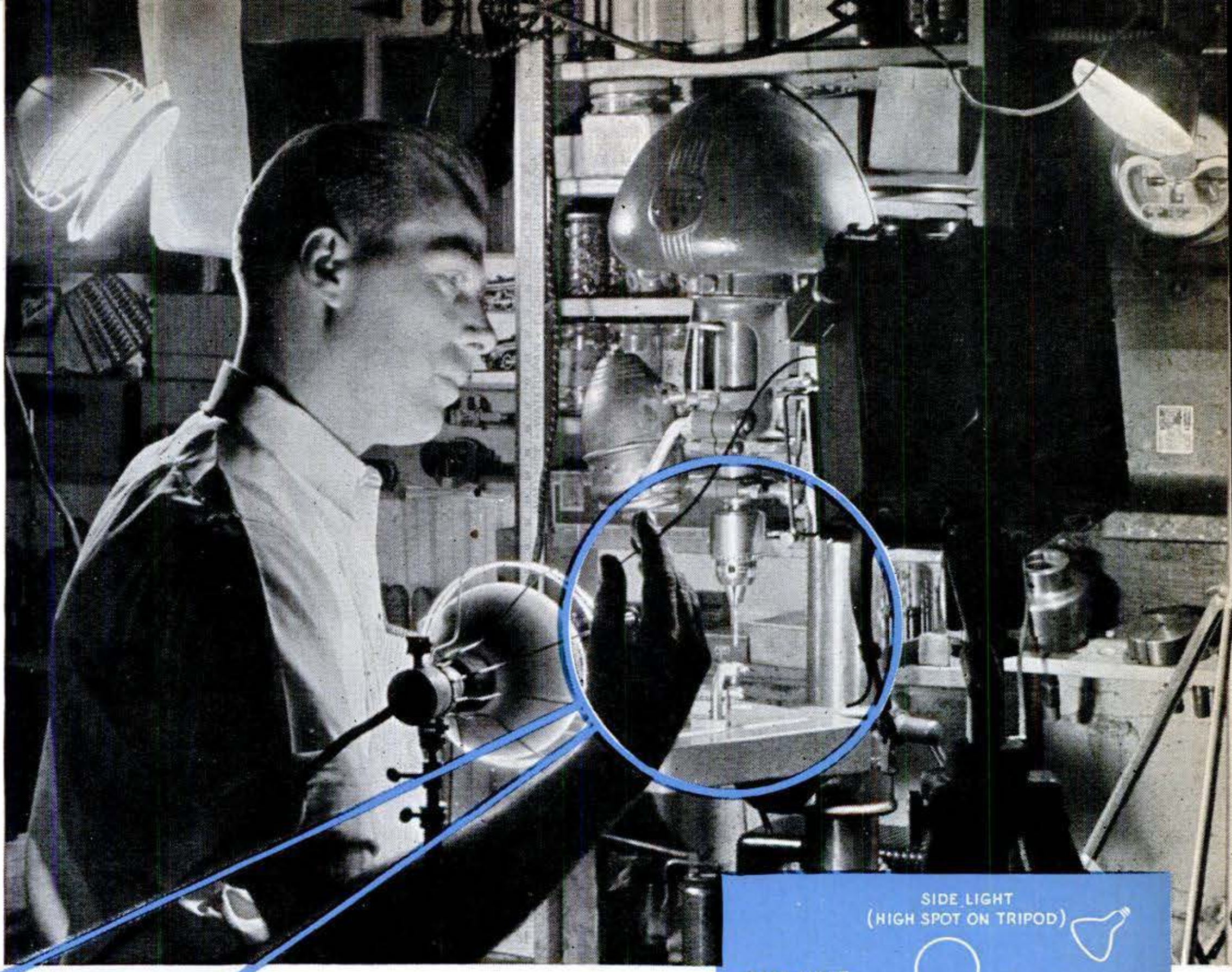

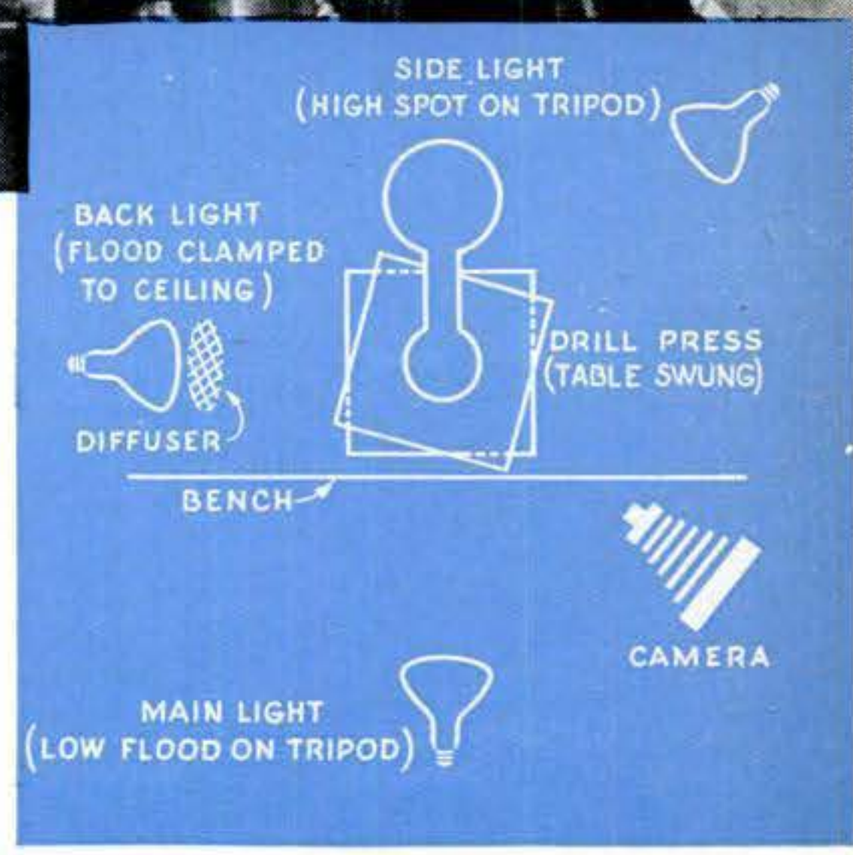


**How it was done.** Drill-press table was swiveled for best camera angle. High spot at right served as cross light. A flood on a floor tripod next to camera provided a fill-in light, and another flood clamped to a ceiling joist at left lightened cross-light shadows.

will call for short time exposures, and a rigid camera support is indispensable. The cable release lets you trip the shutter without jarring the camera, and the sunshade prevents lens flare from lamps near the picture area.

If you have an exposure meter, by all means use it. Keep a record of its readings and of the exposures used until you learn whether you're inclined to read high, low, or just right. And don't read your meter against reflections from polished metal.

***Lights.*** A photoflash synchronizer and multiple-flash extensions are excellent for this work, but involve an extra investment. Also, since at least two and usually three flashbulbs are required for each exposure, the cost per negative is high. Flood lamps, serving for many photos each despite their short rated life of six hours, are a good compromise. If you already have reflectors, you can use the inexpensive lamps that resemble ordinary light bulbs. The medium size (No. 2) is the most useful. It draws 500 watts.

If you haven't reflectors, the somewhat more costly reflector flood lamps are a good buy. These have an efficient reflective coating inside the glass. They come in two types, a flood that spreads light at a 60° angle, and a spot that concentrates it in a 20° beam.

Lamp tripods are very handy; you should have at least two. A third lamp socket may be the popular spring-clamp type. You can often use an old floor lamp or a gooseneck desk lamp. In buying cords and sockets, it pays to get heavy-duty ones. These lamps put out tremendous heat, so the sockets have to "take it." Cords are dragged over the shop floor, walked on, and generally take a beating.

Three lamps drawing 500 watts each are all you should load on one circuit;



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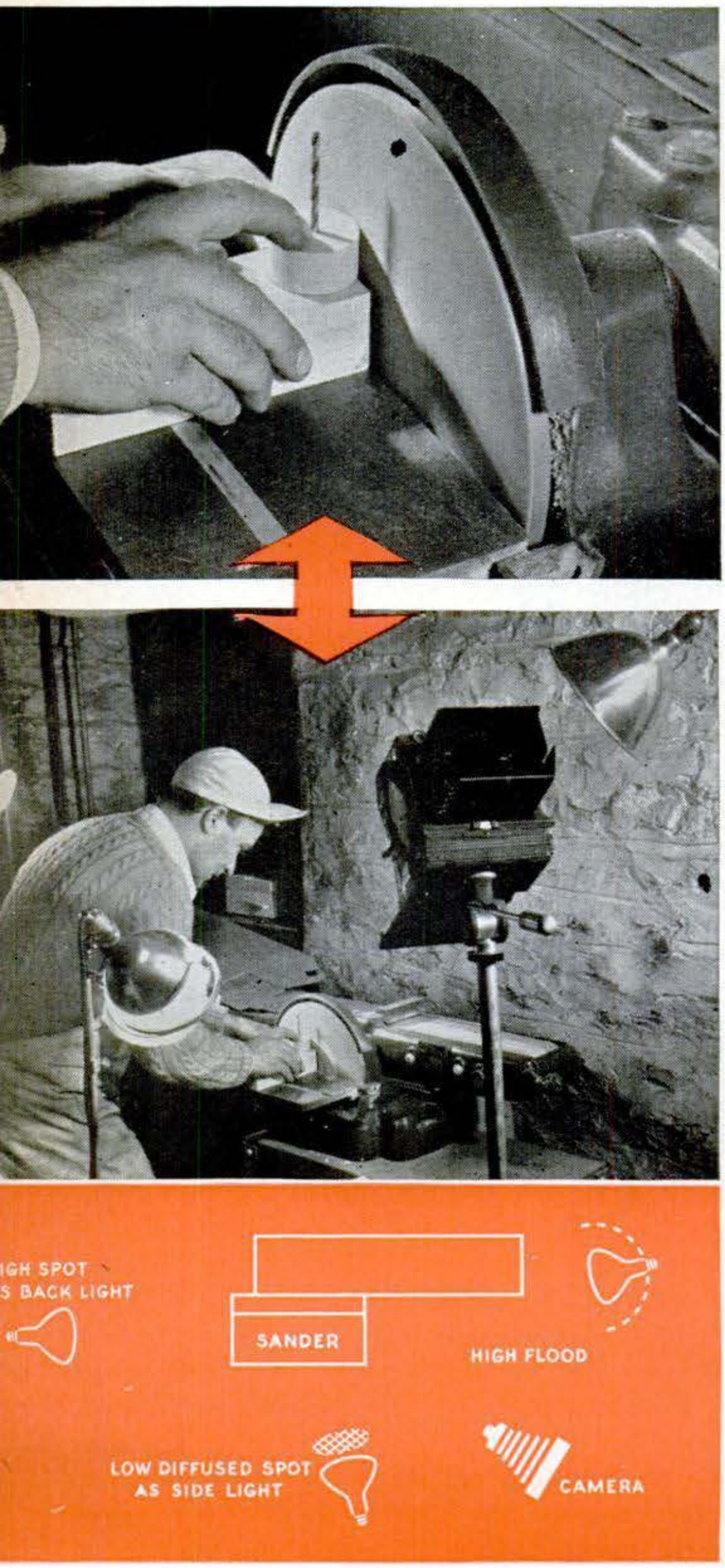
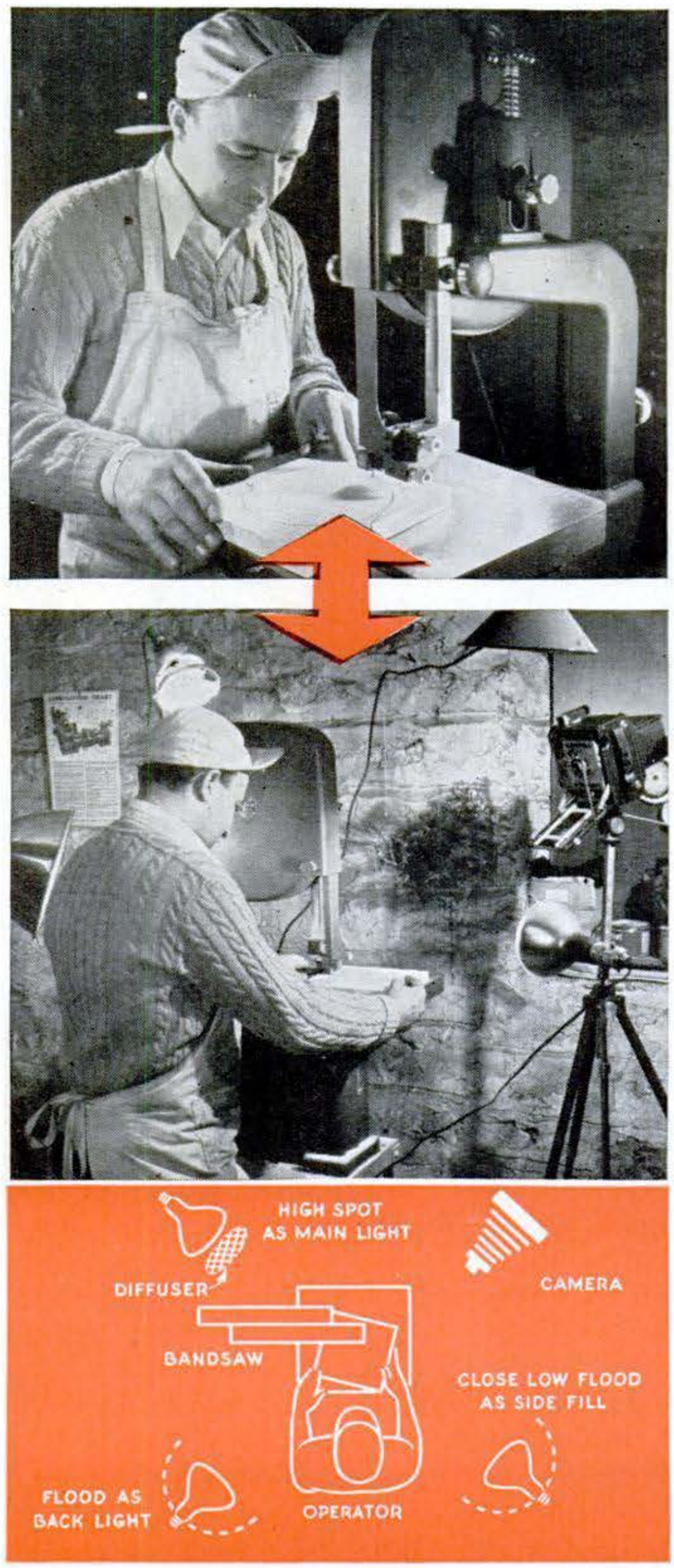
more will blow a standard 15-amp, fuse (and it's bad practice to insert a bigger fuse). If you run a power tool while taking a picture, be sure it isn't in the same circuit.

***Shooting angles.*** You'll have to tailor your shots to the shop layout. If your lathe backs up against a wall, you can't shoot from behind it as was done in two of the accompanying photos. Try for another angle that will focus attention on the important features of the picture. Seek angles that will cut out distracting detail; a tool rack or a




**The low-down on sanding.** A high spot to left of operator gives sharp back-lighting. High flood at right of camera softens the sharp shadows, and a diffused flood low down at left adds texture to hands and metal, and roundness to the wheel being shaped. Note good tone in the hands. Too much light would "whitewash" them. The diaphragm was stopped down to f/45 for this shot, with a ½-second exposure.




**Bandsaw job was shot** from in back. High spot behind saw (visible above operator's head) with diffusion filter on bulb is main light, overbalancing much closer spot at table height (at right in photo above). Back light at extreme left, trained down on table from shoulder height, is screened from camera lens by upper wheel guard of saw. It high-lights the face and left hand.



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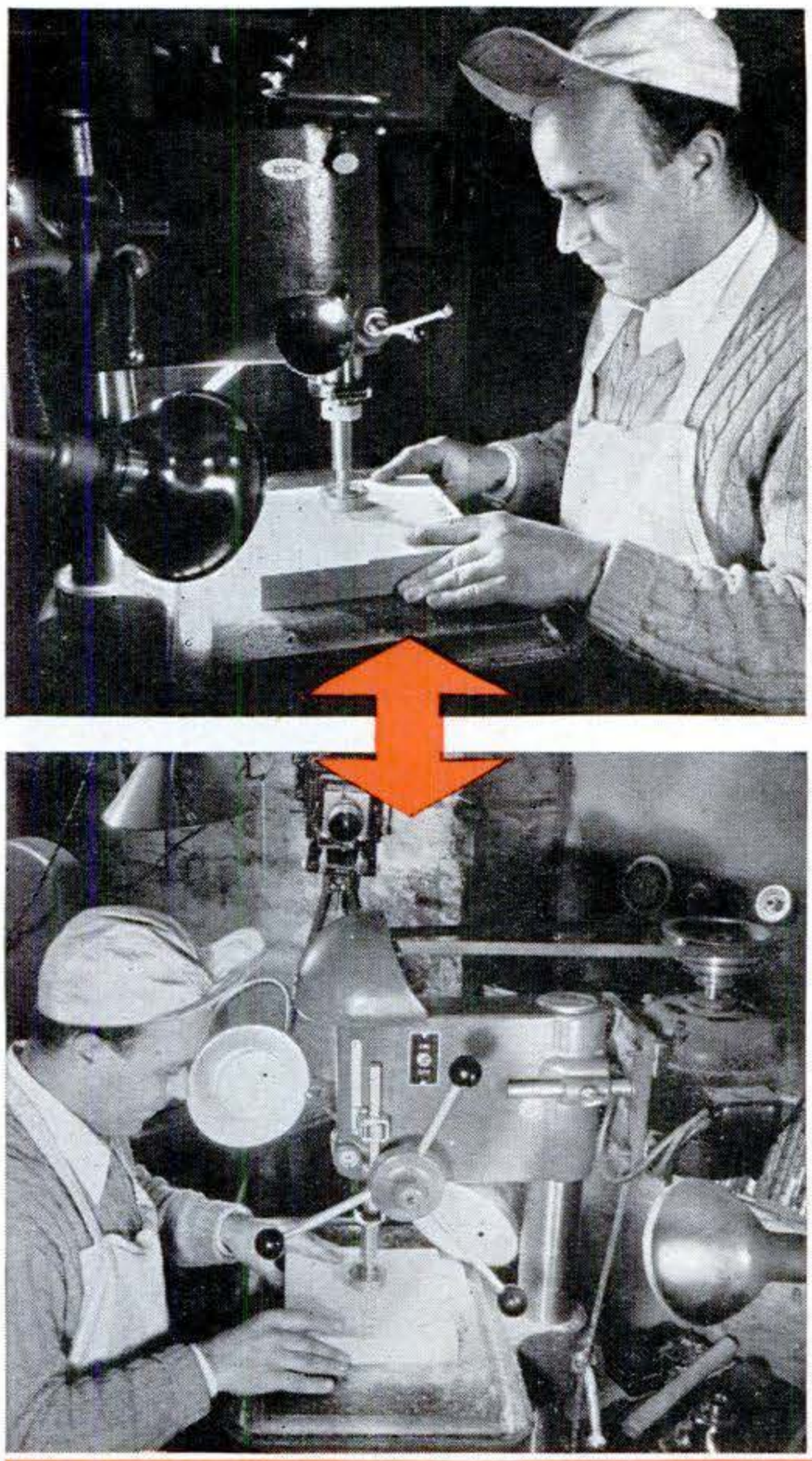
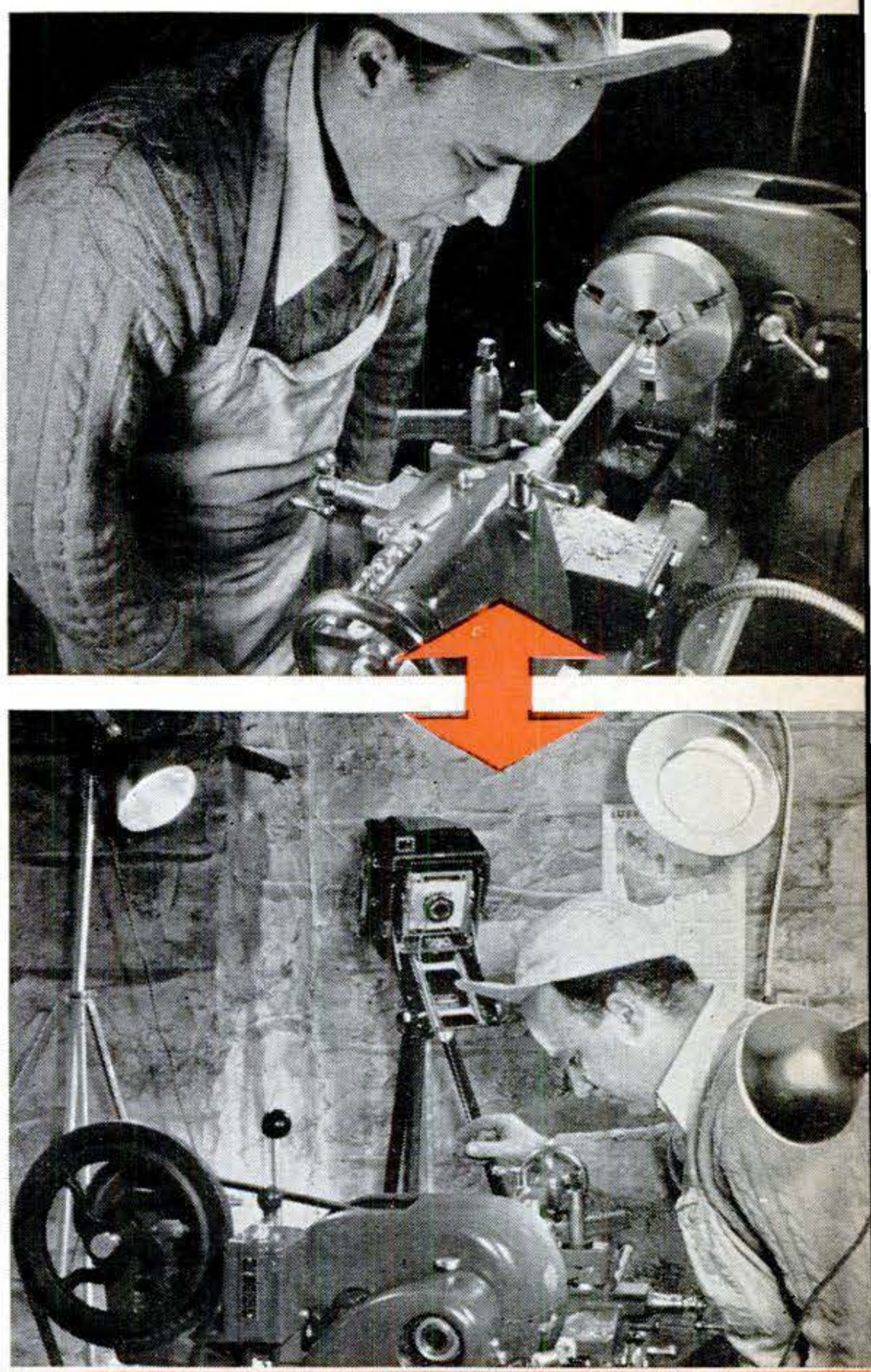
jumble of hardware may yank the eye right away from what you're trying to show. If such extraneous detail is unavoidable, you can do a lot with lighting to kill it. Sometimes you can slip a piece of poster board (cardboard) into the background, as in the accompanying close-up of a steam engine.

The first step is to put a flood lamp on the subject so that you can see it on the ground glass. Set up the camera and try for the best shooting angle, moving the light around as necessary for a good image.




**Chips fly** as a rotary planer tackles a piece of poplar. A small (No. 1) flood bulb was put in the drill-press gooseneck lamp. It doesn't kill the shadows formed by back spot to right, screened from the lens by the machine. This also back-lights the face. Light nearest camera fills in face and body.




**Screw-cutting operation** shows both ends of long rod in lathe, a tough assignment. Camera saw it from a corner behind the tailstock. Tripod spot at operator's left back-lights him and the tool post. Fill-in light is a high flood in a floor stand at camera's left (behind operator). A side light in tripod placed on window sill gives roundness to the chuck, tailstock, and belt guard. Exposure: 1 sec. at f/45.



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Once you have the camera right, focus it, with the diaphragm wide open, on the important feature of the picture. Get this sharp and don't worry about fuzziness in areas before or behind it just yet.

***Depth of focus.*** This is photo lingo for the distance, in front and behind the plane you've focused on, at which things are still pretty sharp. With the lens wide open and close to the subject, things an inch or less from the object focused on may begin to blur. But close the diaphragm, and they sharpen up. When you have to shoot at an angle that calls for good depth of focus, close down to f/22, f/32, or even smaller.

Such small lens apertures mean that you have to make comparatively long exposures of ½ to 3 seconds. Use ample light and fast film to help keep exposures down. Hands mustn't move while the shutter is open, so put them in a position you can hold easily.

***Lighting setups.*** Shop layouts being what they are, you can't always achieve perfect triangle lighting. Thus the lighting shown on these pages wasn't always technically ideal, but it worked out.

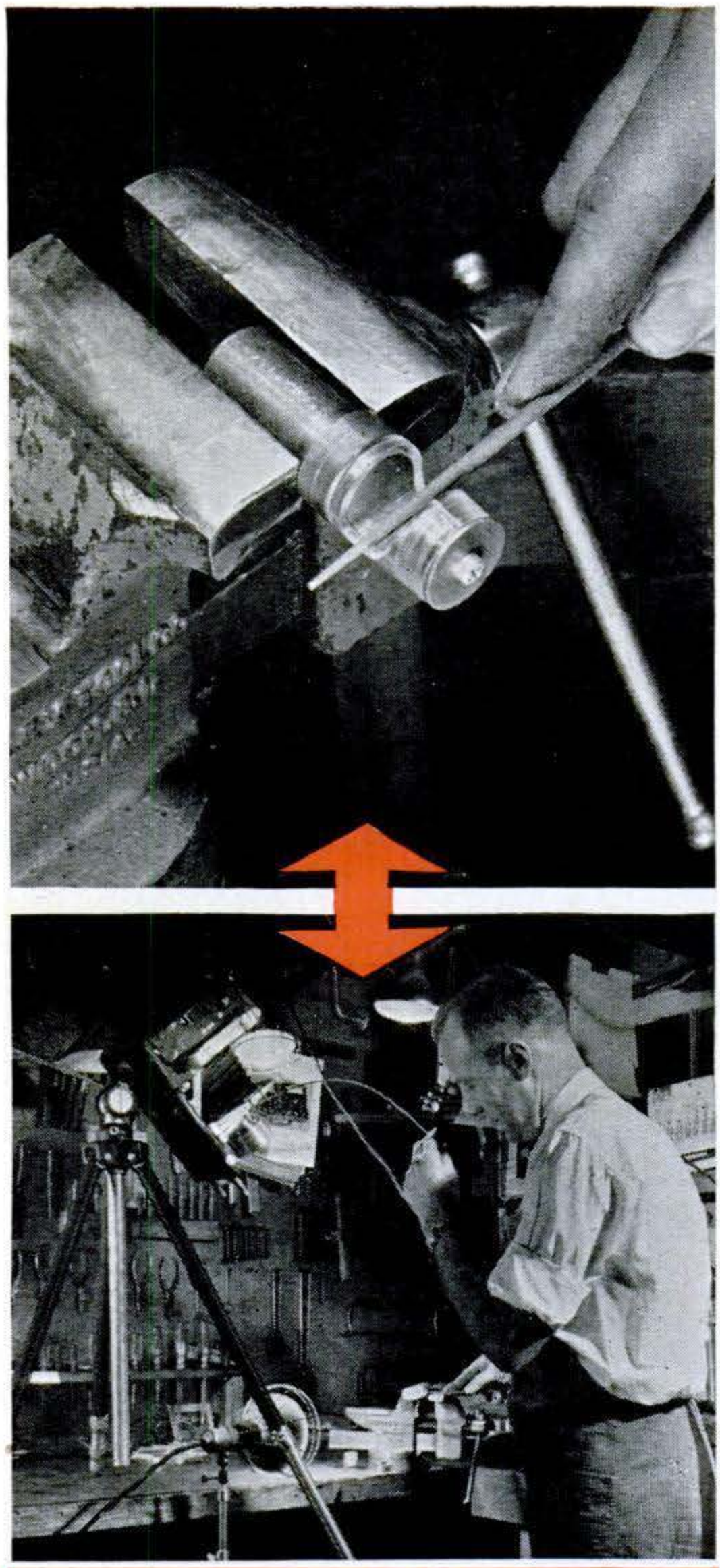
Two lights are basic to almost all setups —a side or back light (or one that's both), which is usually a reflector spot; and a front fill, which gives your exposure reading. A third fill, usually on the opposite side, fills in critical areas, kills unwanted shadows, or perhaps high-lights a tool.

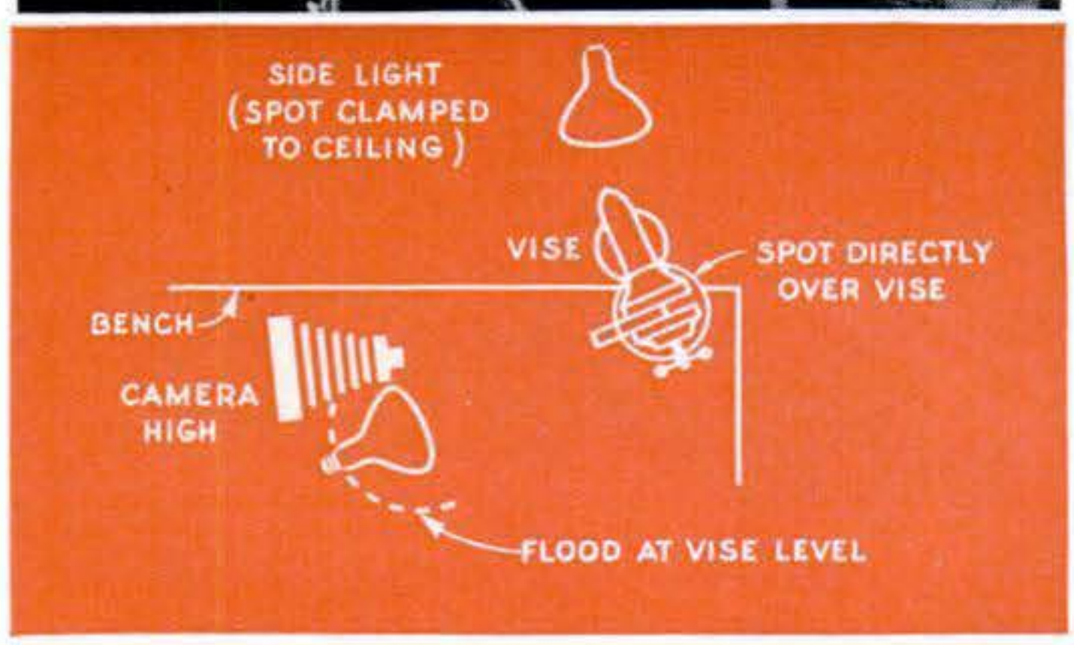
To show chips, shavings, and work texture, experiment with that third light. If the shadows are too deep, soften them by moving the side light back, but not so far that the front light makes all its shadows disappear. Shadows give depth and reality. Flooding with front light makes everything flat.

Proper lighting will leave the background and other nonessential areas dark. In hand shots, beware of flooding the hands with light; they'll turn out chalk-white.

Your ground glass is of great advantage in placing lights. If the image is dim, study it under a black cloth. Watch the effect of moving the lamps about. If you find the upside-down image confusing, hold a mirror by the ground glass at a 45° angle to turn the image right side up.

***Action.*** For variety and realistic effect, some pictures should show machines in action. Smooth-running machines can actually be turned on. But if power causes vibration, the same effect can be obtained by pulling the drive belt by hand during a short time exposure. **END**






**Vise close-up** shows great detail. Here a spot is directly over the vise, aimed straight down. A side-lighting spot clamped to a ceiling joist comes in from the left of the camera. These would leave the lower part of the vise in deep shadow, so a flood at vise level is set up almost under the camera. The vise itself was swiveled to obtain the best camera angle. The exposure was ½ second at f/45.



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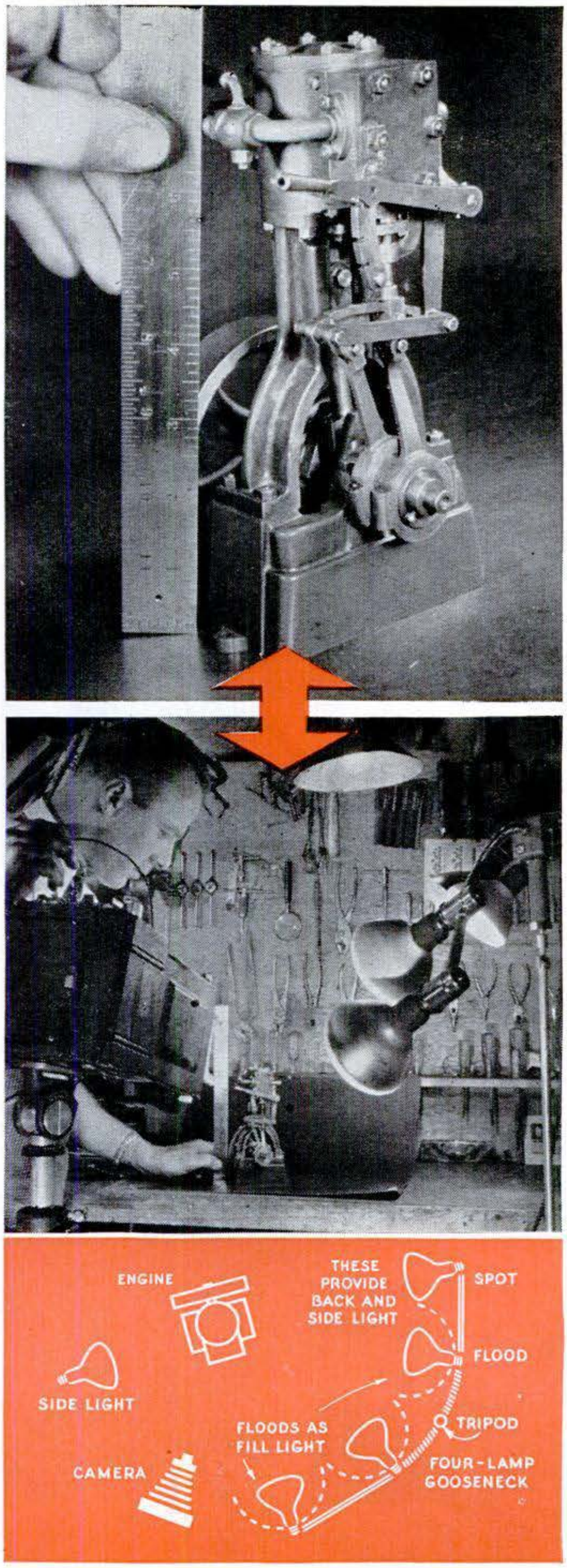
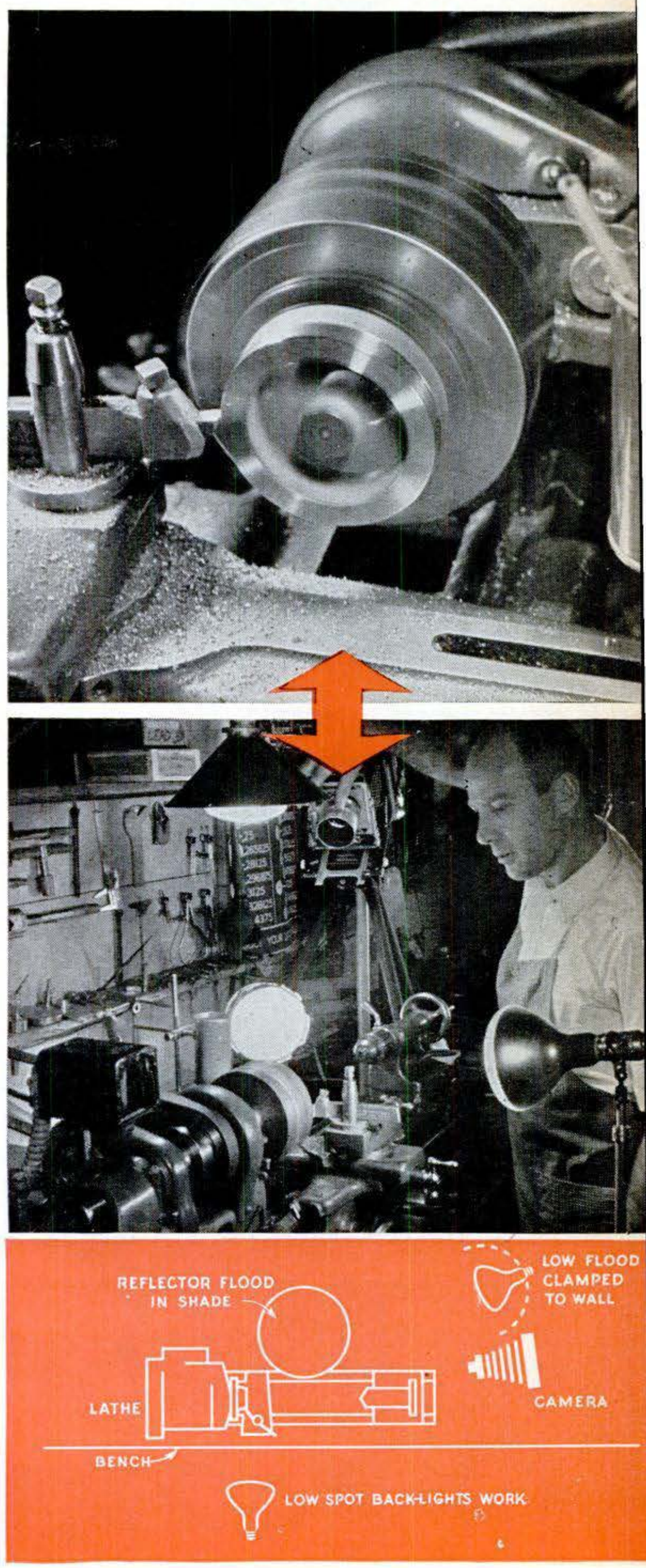



**Models demand painstaking setups.** Note cardboard under the engine to provide a plain, nondistracting background. Curved up, it introduces no annoying "horizon line." Four-lamp gooseneck fixture provides both side and back lighting. Another flood at left is hidden by the operator. Picture was shot at 1 second, f/32. Rule, hand, or other familiar object is desirable in a model photo to indicate scale.




**The camera climbed** the bench to get this lively shot of a flywheel being turned. One flood was in the bench light directly over the lathe. Another was clamped on the wall tool rack. The back spot light, here in the foreground, high-lights the lathe bit. Action blurs flywheel spokes, but the rim being turned is sharp since it has been machined to run true. Exposure was 1 second at f/45.



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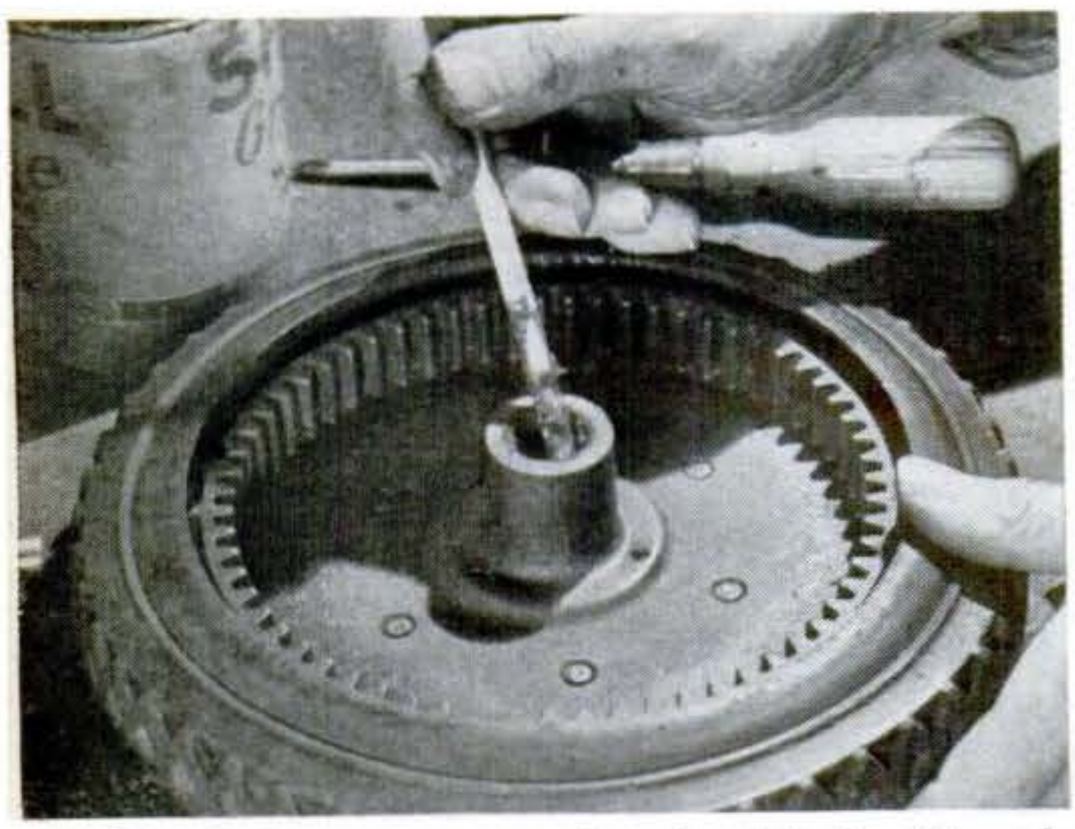
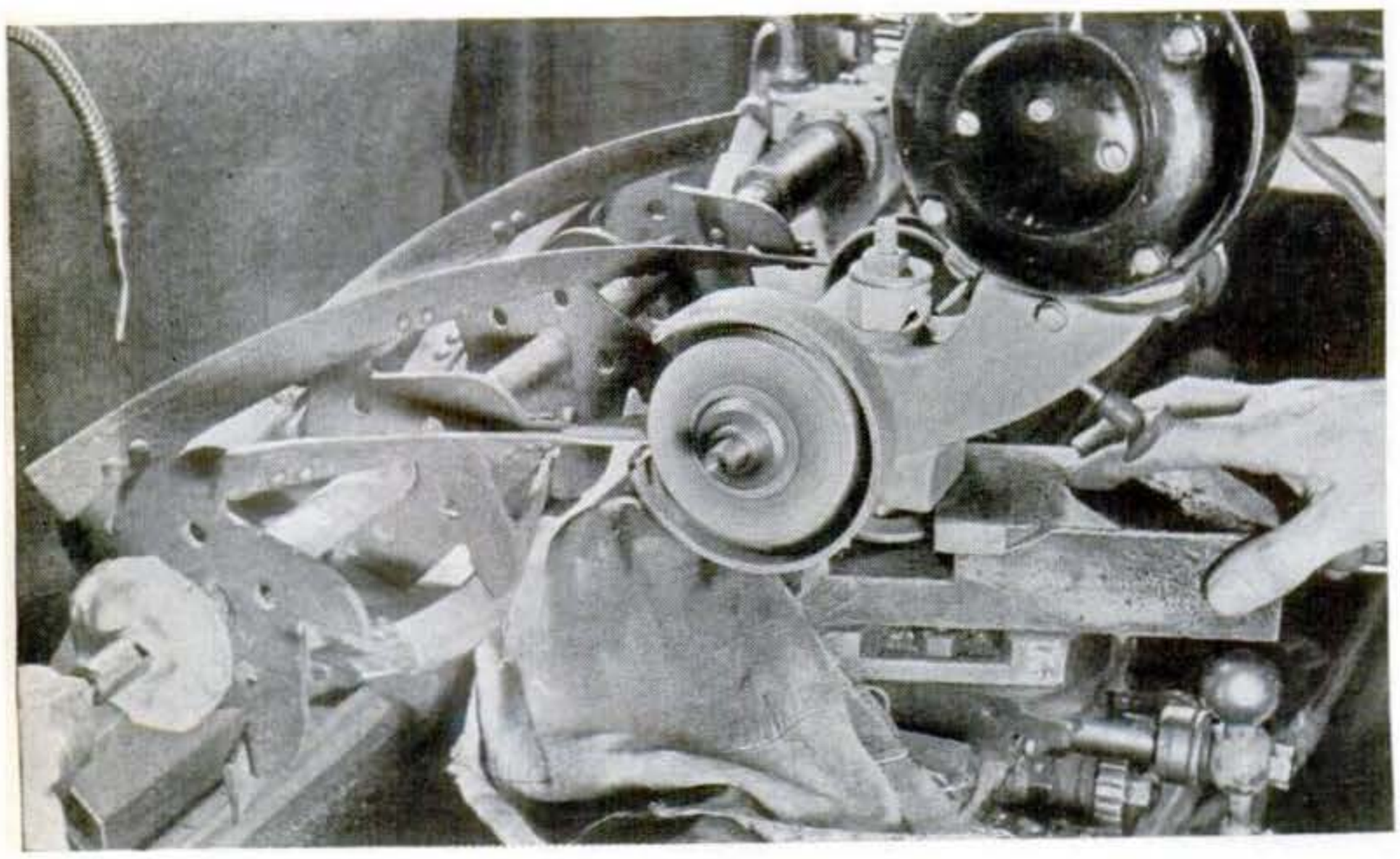
# Don't Cuss Your Lawn Mower

**Overhauling it now may improve your disposition later this spring.**

1 **Stiff bristled brush** and solvent—kerosene or dry-cleaning fluid—are used to clean pinion gears and other parts. Keep solvent out of ball bearings. It may get harmful dirt into them.



2 **Putting new grease** in wheel hub. There's usually a grease groove inside bronze sleeve. Old grease should be dug out and parts washed with solvent before new grease is applied.



3 **Reel blade** is sharpened with tool-post grinder in lathe (left). Rest or finger on guard of grinding wheel regulates position of blade with respect to wheel as carriage is moved.



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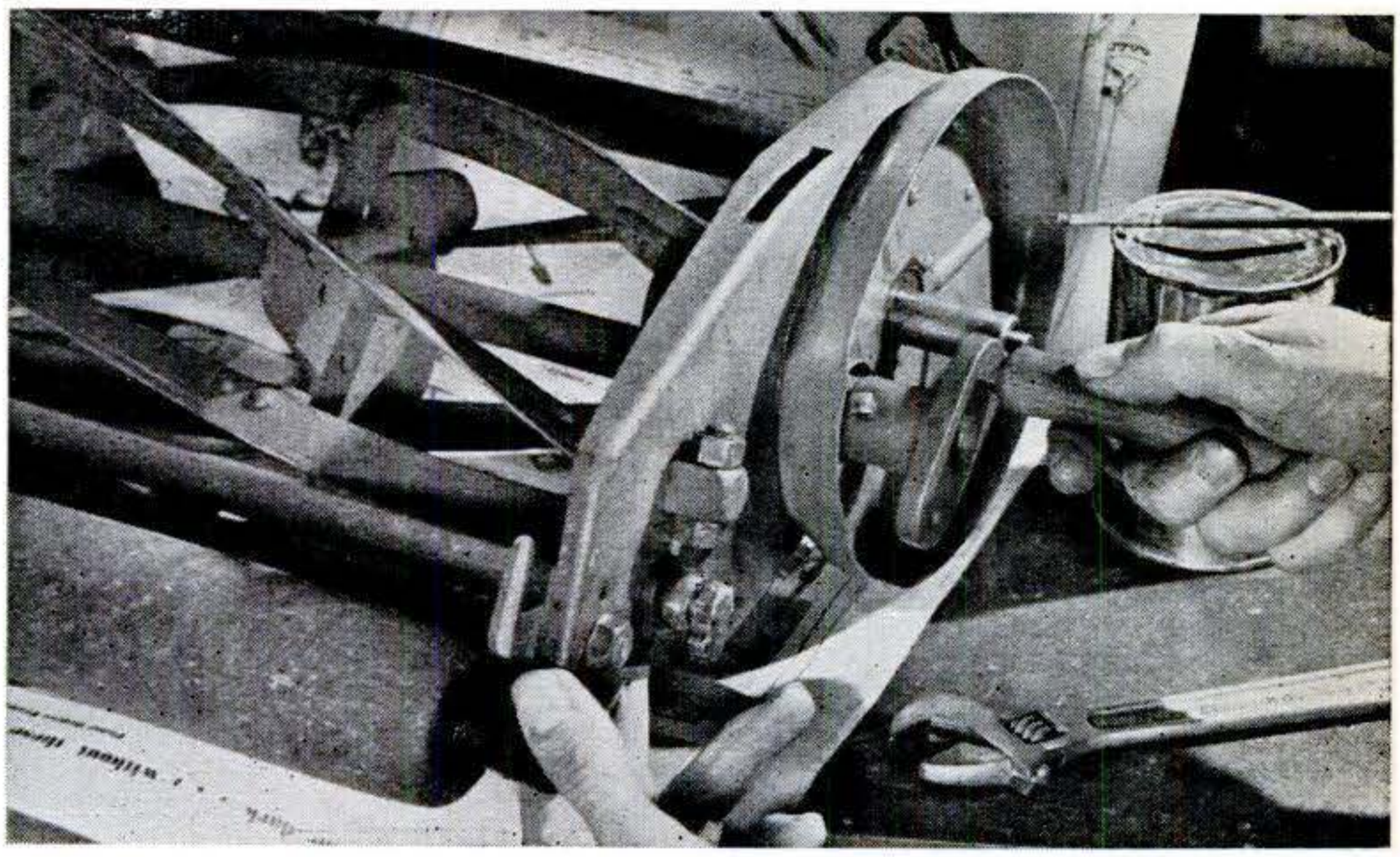


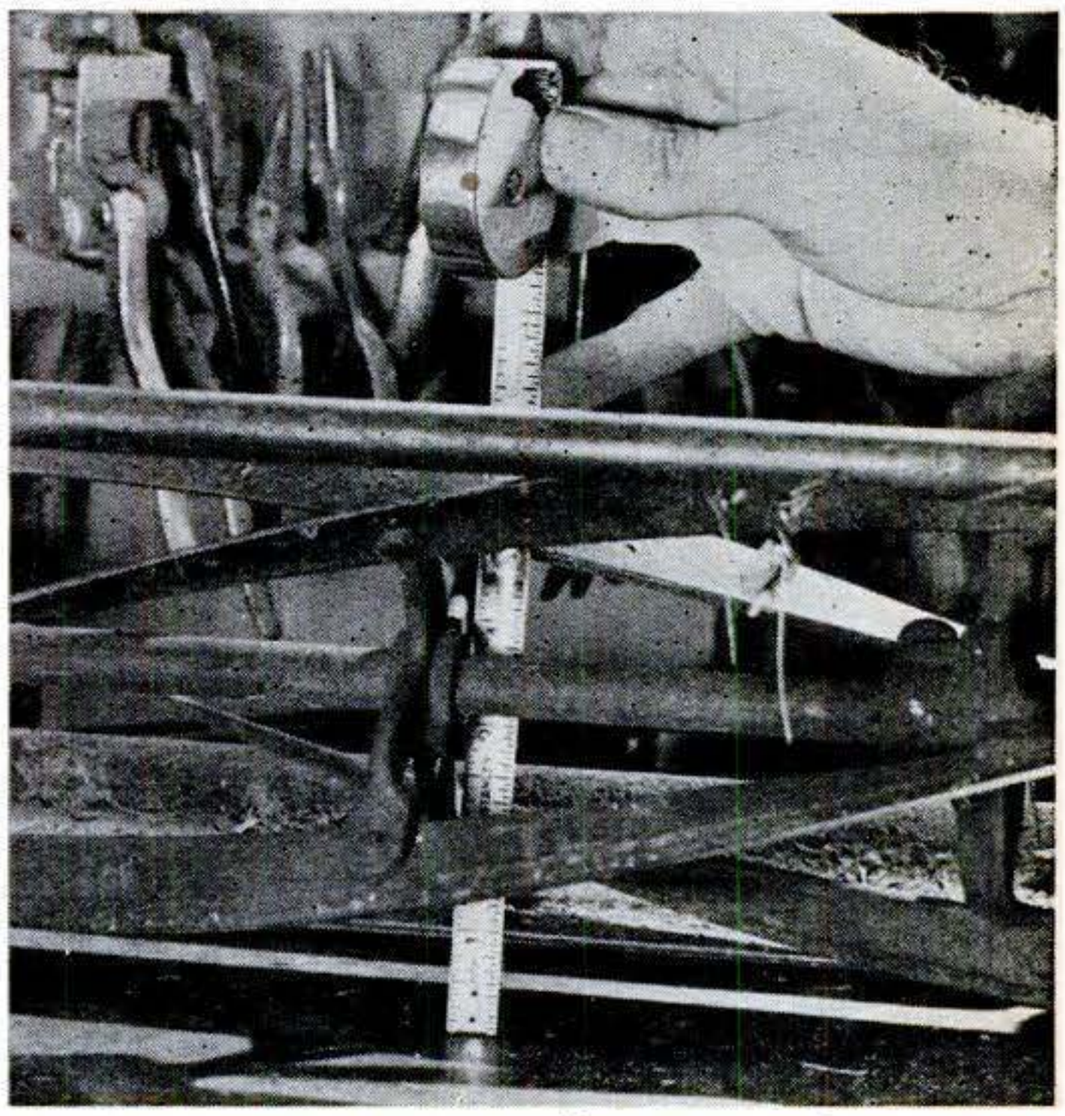
**4 Easier way** to sharpen blades is shown at right. Cutter bar is set even and snug. Abrasive powder in oil is put on edges. Then reel is turned backward, which laps blade edges sharp.

KEEP your mower in trim and it's easier to keep your lawn that way, too.

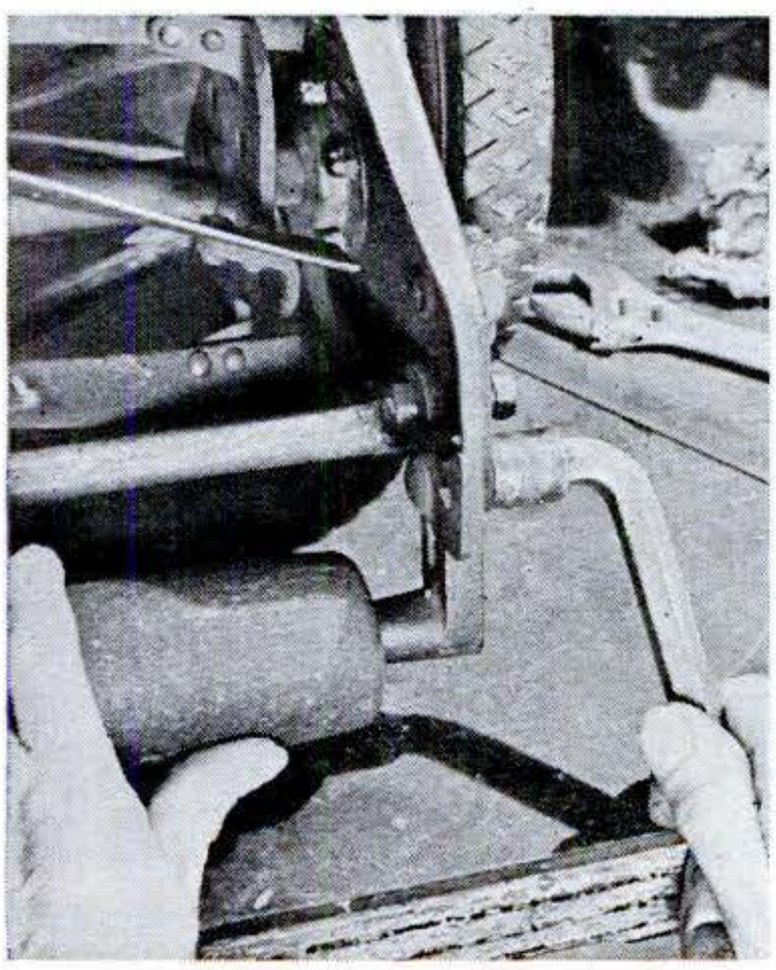
Although mowers differ in construction, most maintenance jobs apply to them all. You can handle cleaning, lubricating, adjusting, and sharpening. On this and the opposite page are suggestions to help you.

After you've completed the overhaul and cleaning, it's a good idea to check every bolt and rivet. Unless a mower is rigid, it can't hold the adjustment between the reel blades and the cutter bar. Test the reel for play by trying to wiggle the shaft while you hold the mower still. If there is play in the reel bearings, take it up if you can—or rebush them.

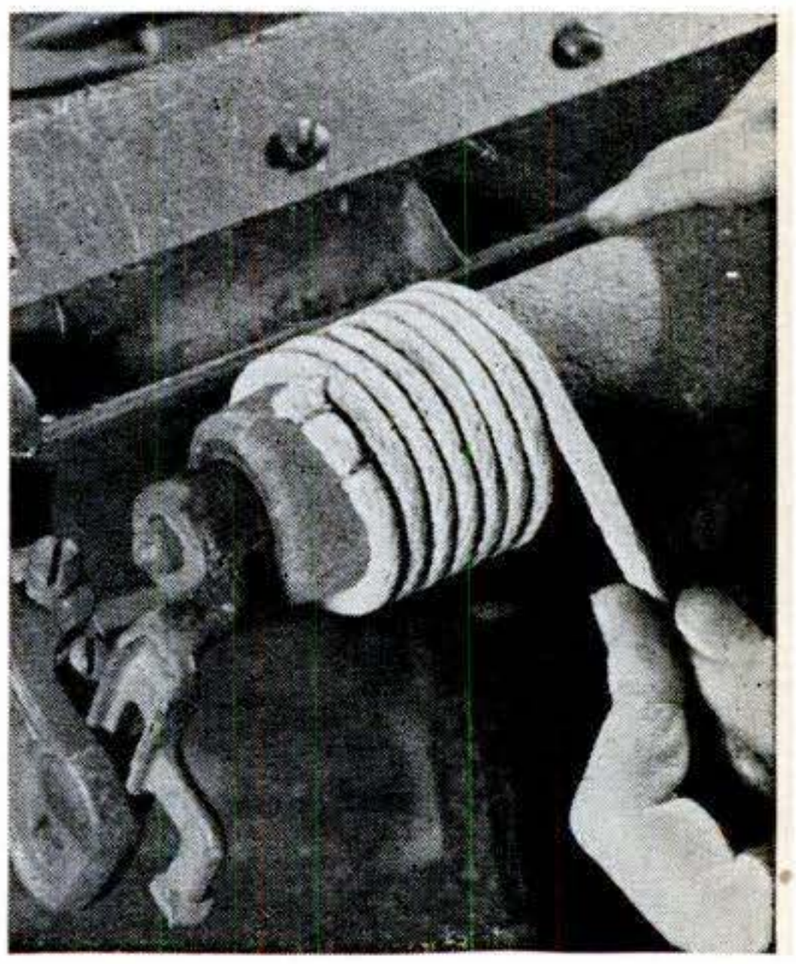
Some mowers require oiling every week or so. Others are designed to be grease-packed only once a year. If you've lost the mower's instruction sheet, replace the old grease with new grease and use oil elsewhere.



**5 Measuring distance** from cutter bar to surface on which mower stands. This shows height grass will be cut. There should be about 1½" to 2" between cutter bar and surface.



**6 Bolts** at each end (left) are used to adjust roller. Setting of roller determines height of cutter bar. Height grass will be cut is controlled by height of bar. Be sure bolts are tight.



**7 If roller** adjustment is too limited (right), increase diameter by wrapping roller with sash cord, old rubber-covered cable, or small rubber tubing. Staple ends to wooden roller.



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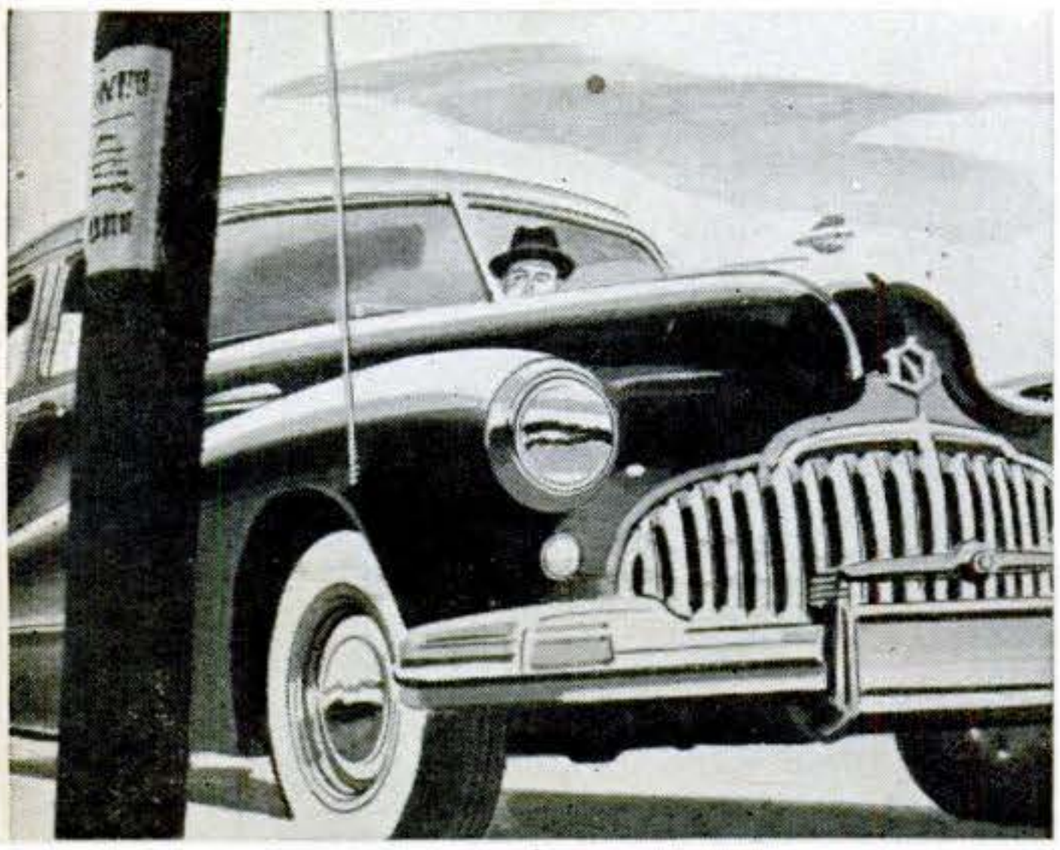
# I'd like to see them make . . .

**Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.**

**Steel tapes with belt clips.** With the tape clipped on your belt, it would always be handy when you wanted it. You wouldn't have to fish in a pocket or walk back to where you'd left it.—*H. D. Cousins, Chicago.*



**Antennas for auto radios** on the right front fenders. This would eliminate the need for a parking guide on that fender. The antenna would serve both as an aerial and a guide.—*Richard Lau, Brooklyn, N. Y.*

**Color stains** that could be brushed on upholstery. These could be used on upholstery that was faded but otherwise in good condition to restore it to its original color.—*Dick Crews, Louisville, Ky.*

**A box in which to shake dust mops.** This could have a zippered top and a connection for a vacuum cleaner. The vacuum cleaner would pull in the dirt when you shook the mop.—*Mrs. Alice Faillace, Rocky Hill, Conn.*

**Hub caps with locks in them.** These locks could be opened by the ignition key. Such an arrangement would help prevent stolen wheels as well as lost or stolen hub caps.—*Don Magnuson, Kerrick, Minn.*



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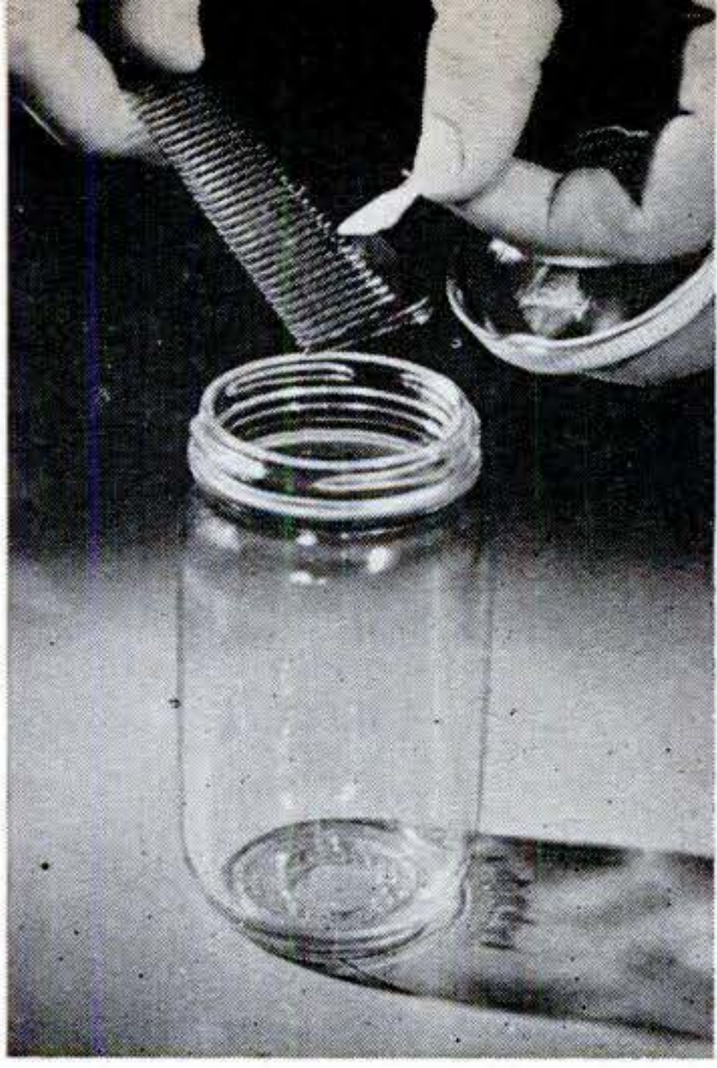


# Think You've Found Uranium? Test It with a Feather in a Jar

If you think you've discovered uranium ore in your back yard, don't buy a Geiger counter until you've made a test with apparatus you can put together for nothing. All you need is an electrified feather hung in a glass jar. A radioactive substance placed inside the jar ionizes the air, causing the feather to lose its charge in a matter of minutes. If the substance is not radioactive, the feather will retain its charge for hours.

Cut about an inch from the tip of a primary or wing-tip feather. Strip the barbs from the thicker half of the shaft. Suspend it by a silk thread taped to the cover of a half-pint jar so it will hang about midway.

Electrify the feather by rubbing it a few times along the back of a clean, dry comb (left above). Then put a sample of suspected ore into the jar and tighten the cover. If the inside of the jar is dry, the atmosphere not too humid, and the ore *not* radioactive, the feather should hold its charge up to 24 hours. If it loses it in an hour or less, the ore is probably radioactive.

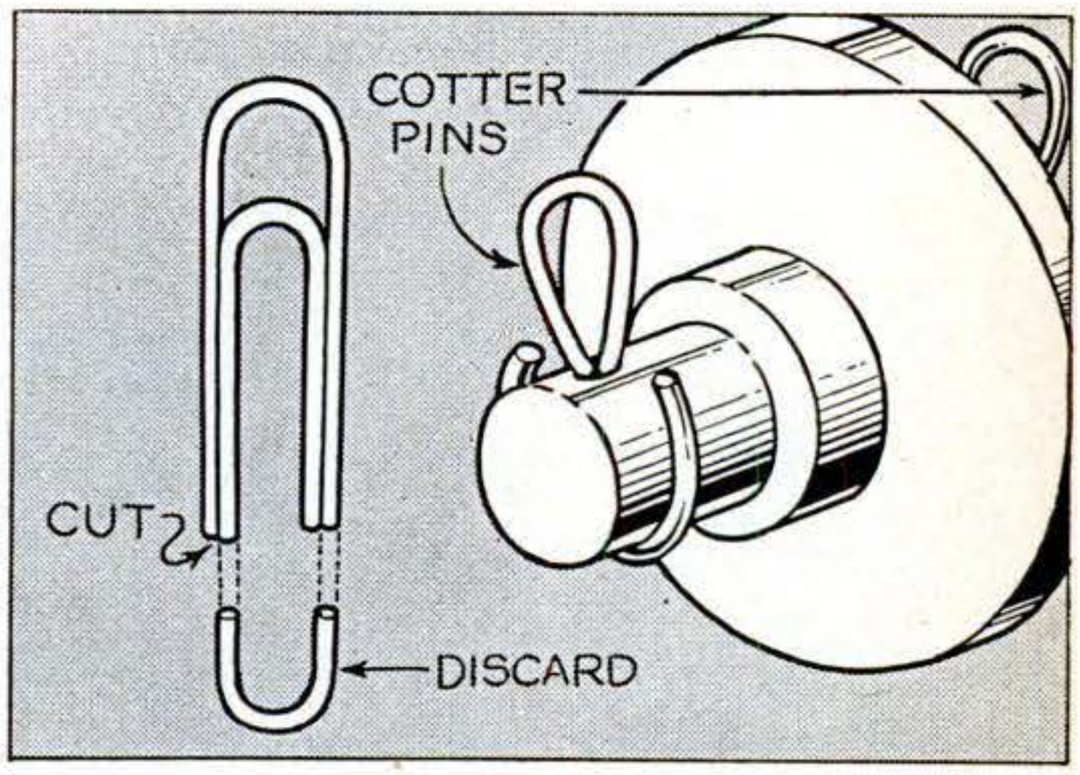
The way to find out if the feather is still charged is to rub a comb on wool and hold it near the jar. If the feather is greatly disturbed, or drawn to the comb, it is still charged (center above). If it is not disturbed, the charge has leaked off (right).

## Doorknob Drives Screw Bit

Because I get results with less effort, I always use a screwdriver bit and brace for driving large screws. But in close quarters, there isn't room for the brace. For such situations, I carry an old doorknob. Its square hole fits nicely over the square shank of a bit. The knob gives a good grip.—*V. J. Hassell, Oak Park, Ill.*

## Toy Hub Caps Are Ready-Made

If you make wheeled toys for your youngsters, you can give the wheels a finished appearance by adding hub caps—shiny furniture glides for the small ones and individual pie plates for the larger. The pie plates, about 3″ in diameter, can be attached with screws through the rims. Simply press the glides in place if the wheels are made of wood.—*Albert W. Stein, Union, N. J.*




## Paper Clip Makes Cotter Pins

Two light-duty cotter pins can be made from a single paper clip. Cut off one end as shown. Hold together the open ends of each U-shaped piece, force them through the hole, and crimp them over in the usual way.—*K. C. Conlon, Lynbrook, N. Y.*



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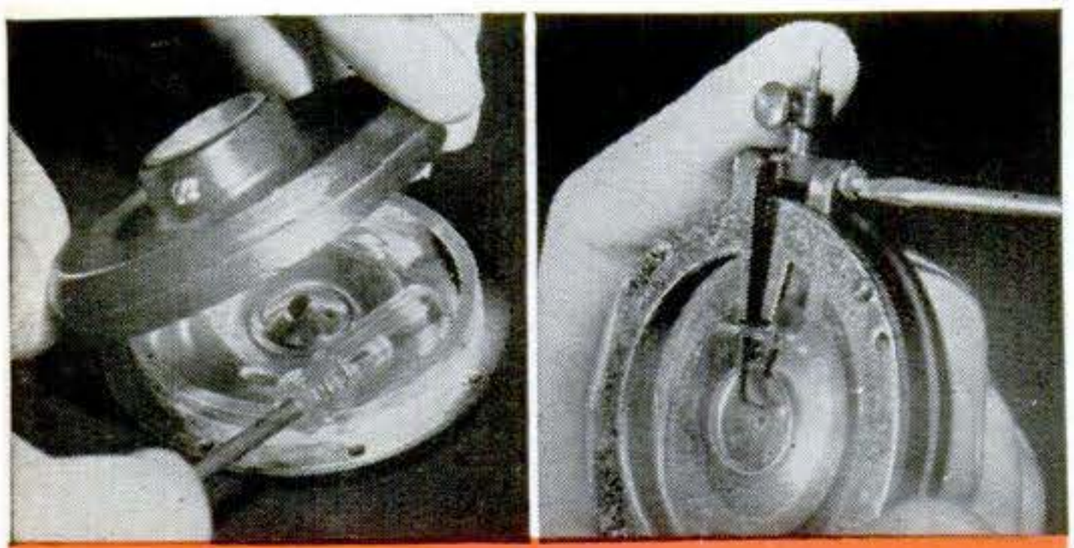
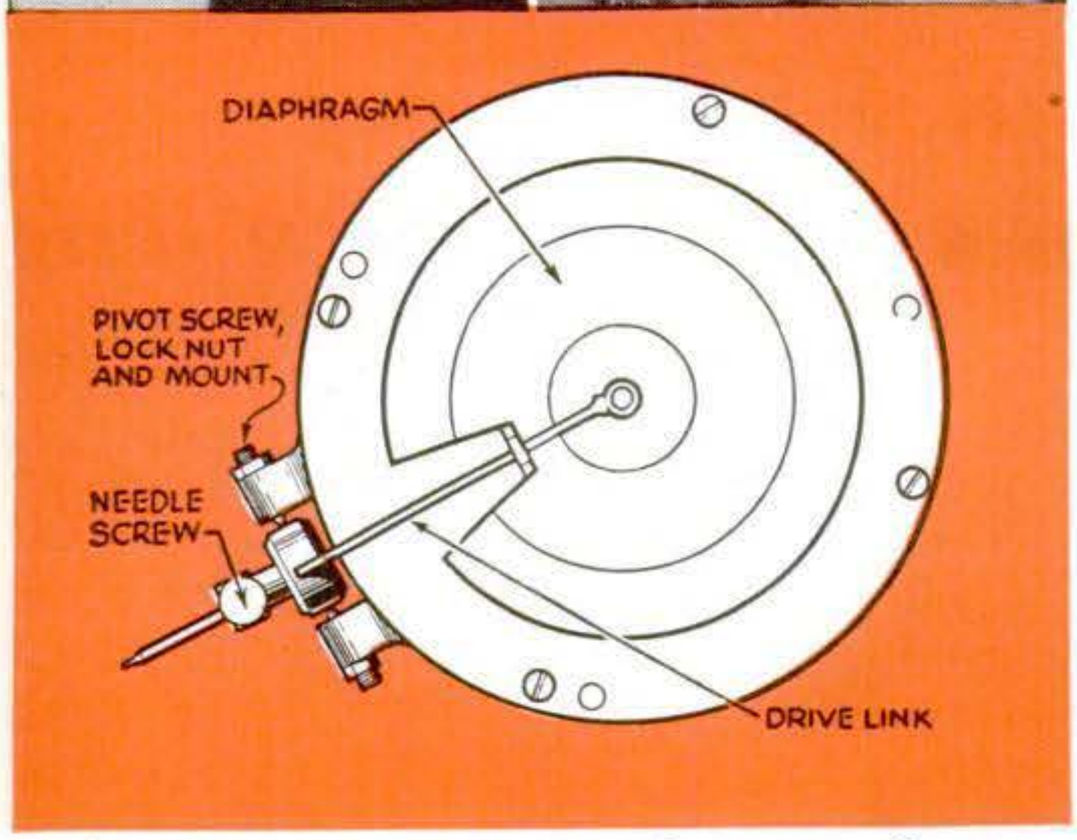
# What Ails Your Old Phonograph?

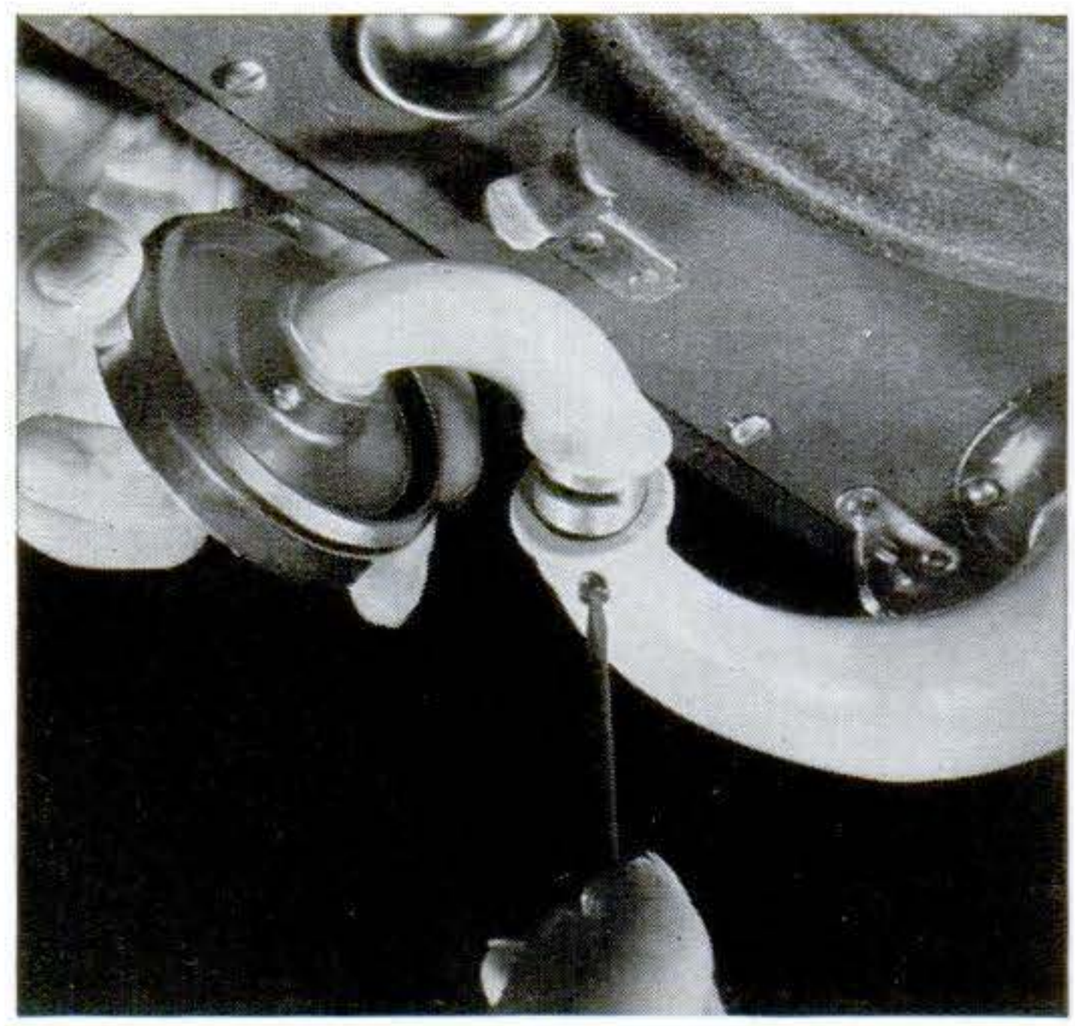




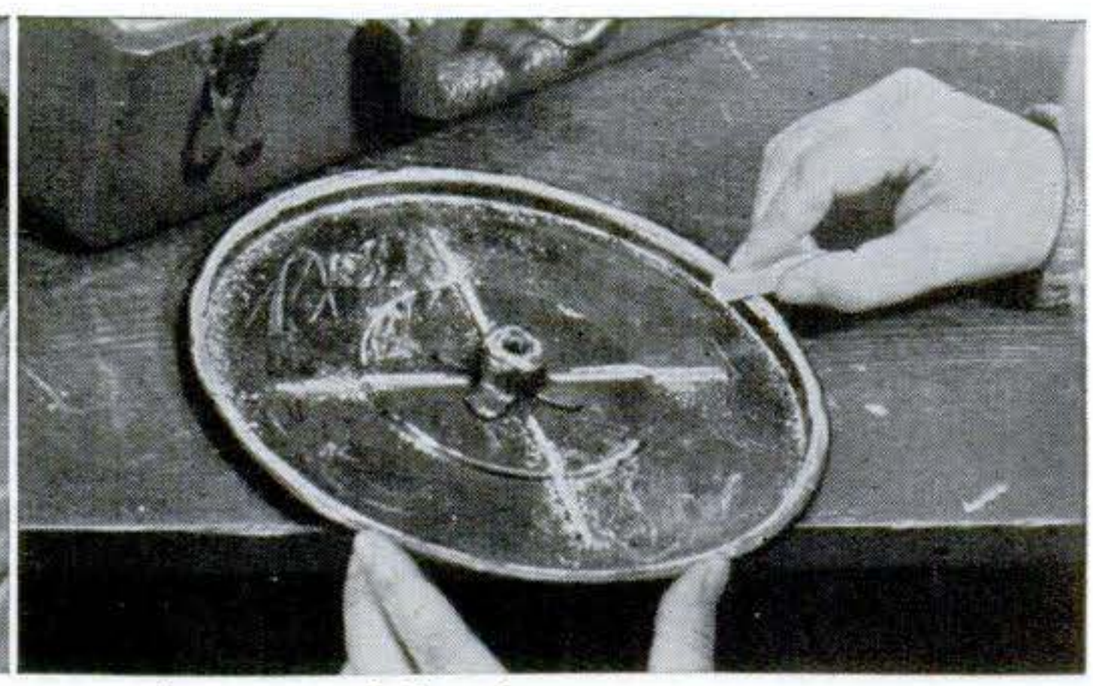

**Is the pickup head okay?** If not, it will either bottleneck the sound or bring it out sour. A damaged diaphragm causes distortion and loss of volume. Small dents may be pressed out.

A needle holder that's too loose causes rattles; one that's tight reproduces records shrilly. Test the holder with your finger. It should have the tiniest amount of play. If necessary, adjust the pivot screws. Don't bother fixing bent or broken parts, for new heads are inexpensive. The new one needn't be identical with the old as long as it fits the arm.

NOW is the time to bring that portable wind-up phonograph down from the attic and put it in shape for summer. Rattles, shrills, wows, and the other awful sounds that phonographs may give out often come from easily correctible troubles. These photos show some of the common flaws and what to do about them.



**Does the needle track?** If it tends to jump the groove, inspect the side-to-side and up-and-down movement of the arm. It should be free in both directions. Polish arm joints with fine sandpaper. If the joint has a slot, make sure it is clean. Apply a dry lubricant such as graphite before reassembling the parts.



**Does the table wobble?** If so, it may bounce the needle out of its track and will probably put "wows" in the music. A piece of chalk tells the story. Hold the chalk firmly, rest your hand on a solid surface, and bring the chalk down till it just touches the felt. If the table is level, it should mark the rim evenly all around. Wobble may be caused by loose or missing mounting bolts or a bent spindle.

If you suspect that the bottom of the turntable is rubbing against the stop lever, speed regulator, or mounting board, chalk the lower edge of the rim liberally. The powder will rub off on obstructions or high points.



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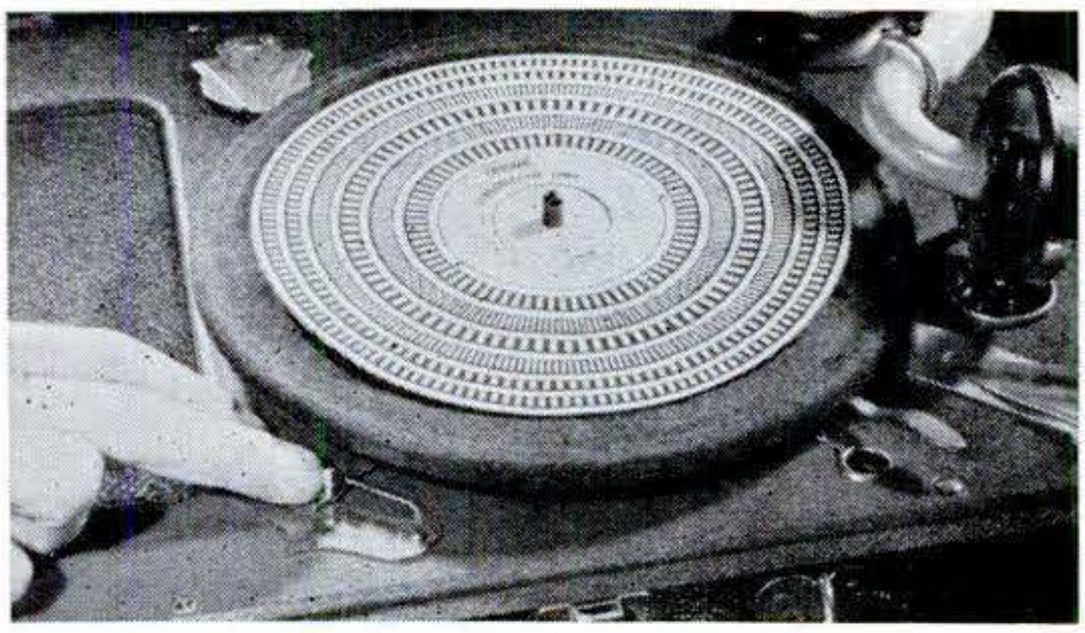
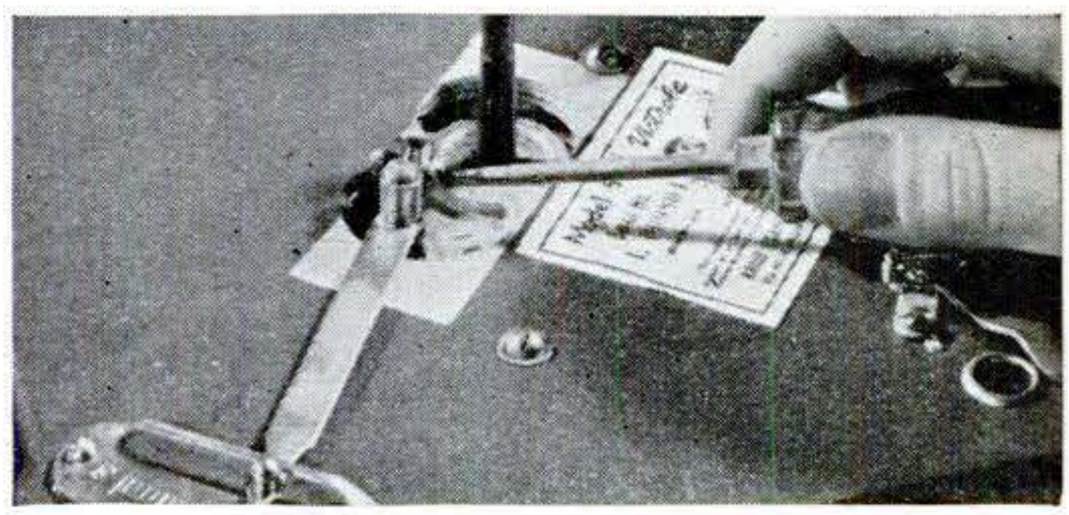
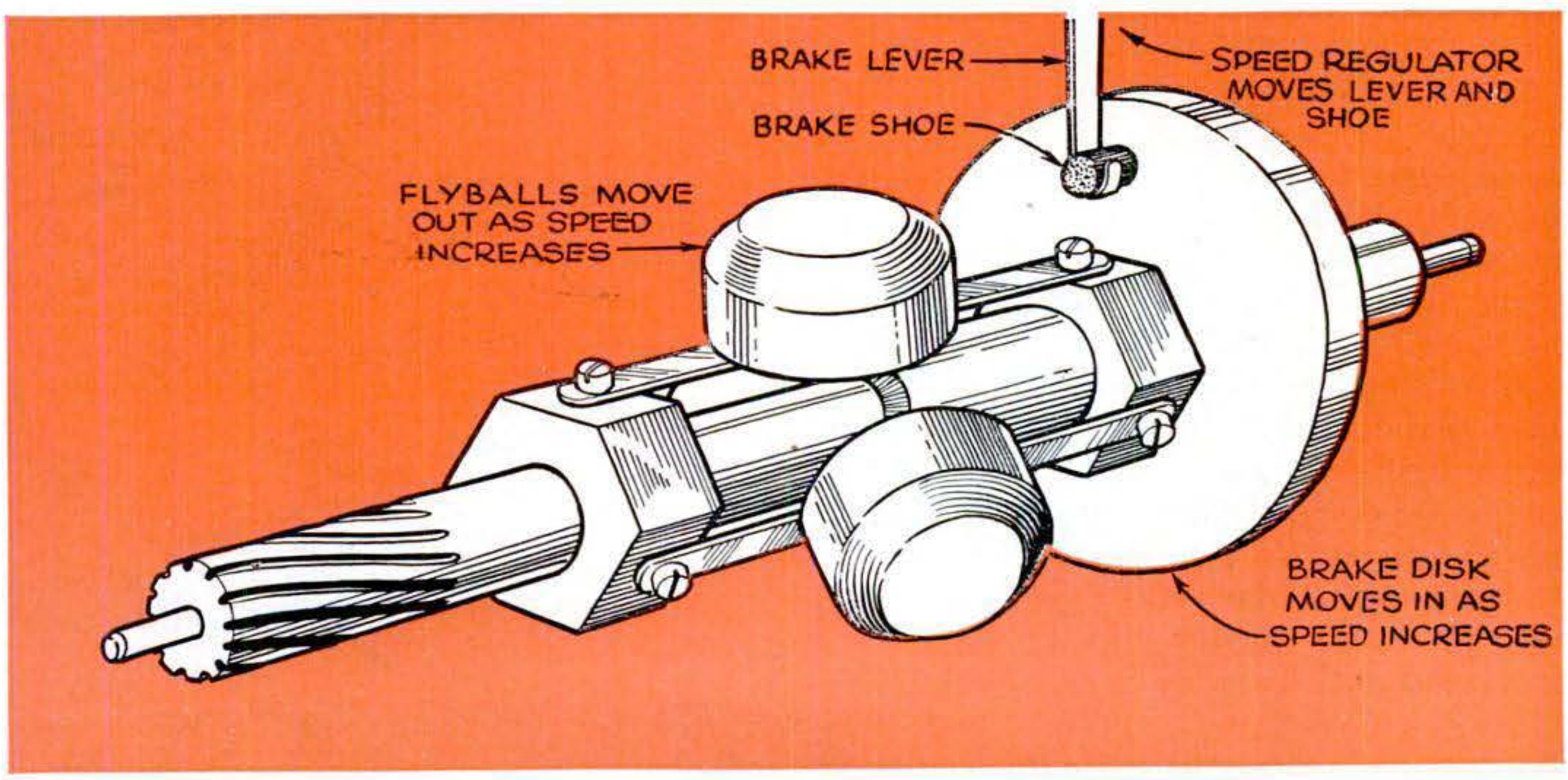


**Is the speed right?** Poor speed regulation can make records sound as if the musicians were being paid by the beat. Or it can turn a fox trot into a funeral march. Adjusting the speed-regulator arm should bring the speed to a fairly constant 78 r.p.m. This can be checked with a stroboscopic disk. Seen under an electric light, one row of lines seems to stand still when the speed is right. The disk shown at the left above has rows for all three phono speeds for both 50- and 60-cycle lights.

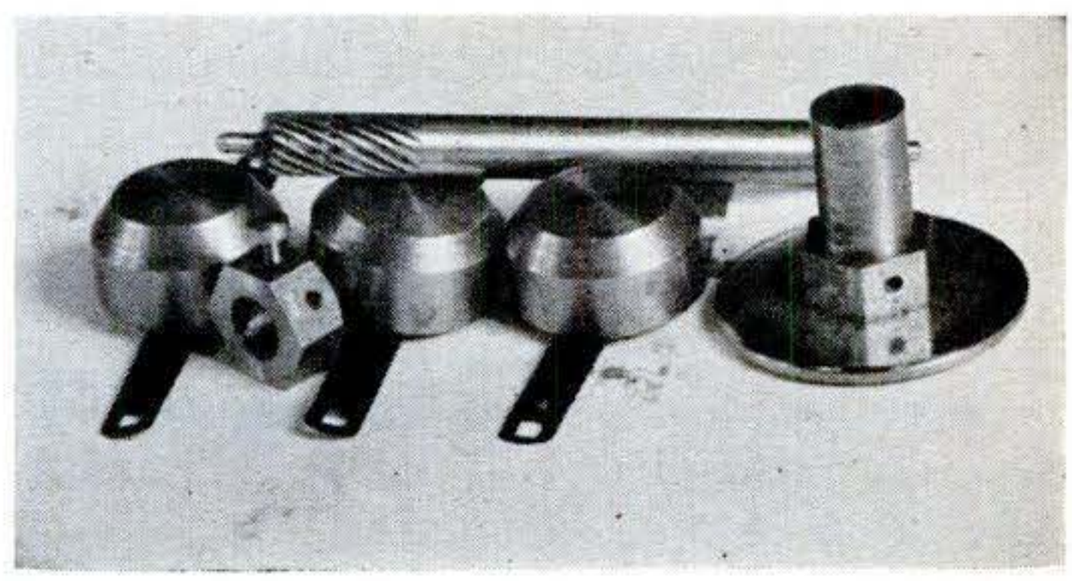
Another way to check turntable speed is to count revolutions, as shown at right. Slip a piece of paper under a record so that part of it projects. Start the motor and count the number of times the paper passes a point in a given time. Adjust the speed regulator until it counts 78 turns a minute.



**Does the regulator regulate?** If not, lift off the turntable and take a look at the linkage to the brake lever. Sometimes the collar that connects the regulator arm and lever comes loose. The collar bolt should be tightened. If the collar is tight, the governor itself may be faulty. You'll have to check that next.




**Is the governor sticking?** The photo at right shows the parts of the speed-control mechanism. Three weighted balls or disks are spring-fastened to two collars on the shaft. One collar —which is attached to a brake disk—is free to slide on the shaft. As speed increases, the balls fly outward and pull the sliding disk against the brake shoe. The three balls must be of equal weight and their springs of equal tension. If movement seems sluggish, the shaft should be polished and lightly oiled. Replace the brake shoe if it is worn or broken.





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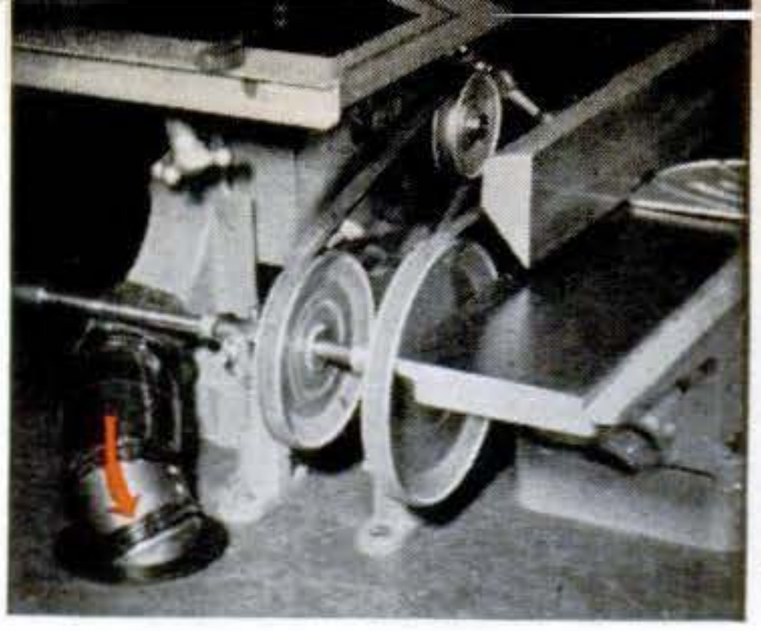
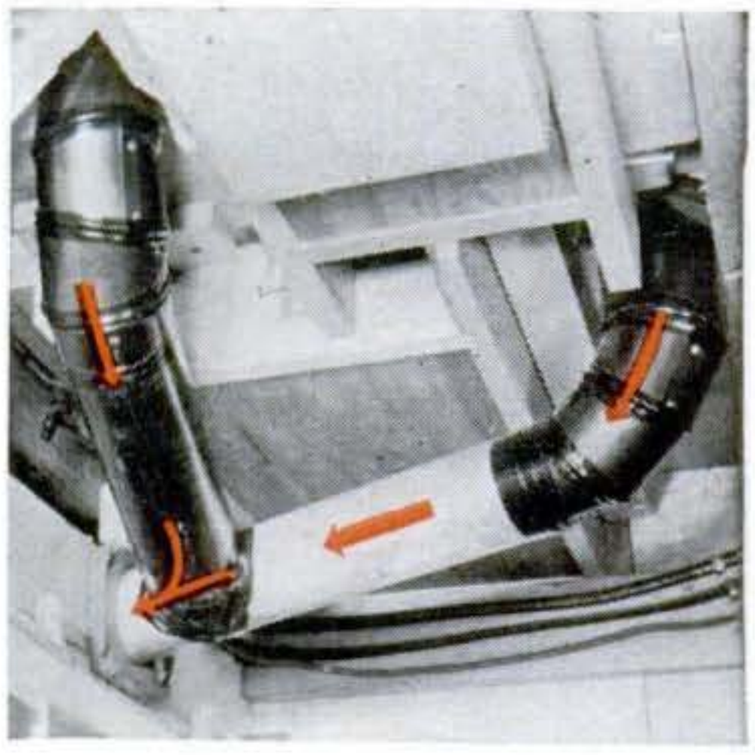
## *Spare the Broom . . .*

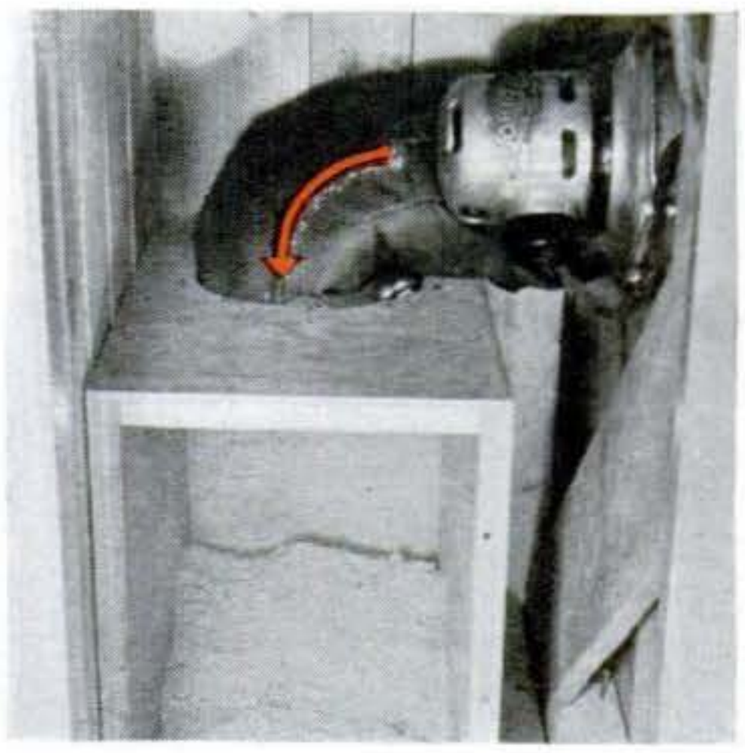
# Vacuum Unit Collects Sawdust and Chips





THAT old vacuum cleaner kicking around in the attic can find new life as a sawdust and chip collector in your shop.

Clean and oil the motor and repair any obvious defects. Saw or file the blower housing as necessary so it can be bolted to a bulkhead mounted under the workbench.



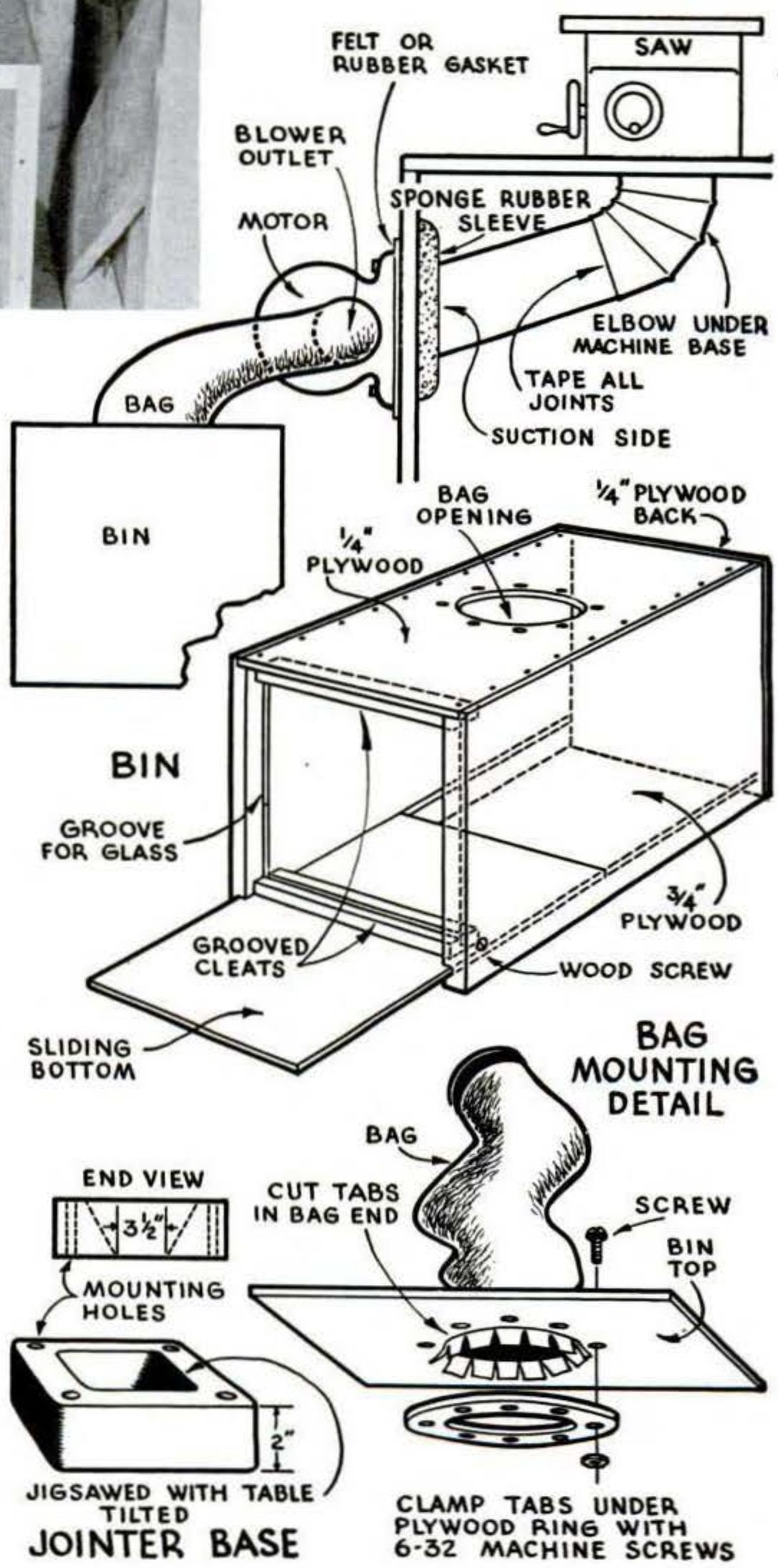
Build a dustbin as suggested in the drawing, suiting the dimensions to the space under your bench. The glass front permits you to see when it is full. Pulling out the sliding bottom empties the bin. Be sure to make all bin joints a tight fit. Otherwise, dust will come out into the shop.

Cut off the closed end of the bag, cut tabs in the edge, and clamp it to the hole in the bin with a plywood ring and 6-32 machine screws. Use the turn-lock fitting on the bag to disconnect it from the blower when the bin needs emptying.

Make the ducts from 3″ stove pipe. Keep them as short and straight as possible, pitching straight runs down all you can. Avoid sharp corners by using universal-type elbows. Connect the main duct to the blower with a sponge-rubber sleeve. Tape all joints.

In the photos above, the ducts run to a bench saw and jointer. The saw already had a convenient dust port. This was coupled to the duct with the wrist section of a rubber glove. If your saw has no port, mount the mouth of the pipe to take advantage of the natural blower action of the blade. The jointer rests on a base made as shown. If you run your duct system to more than two tools, place a damper in each. Close all except the one to the tool in use.

Wire the blower motor in parallel with the power tools so it will turn on automatically.—*Karl Greif, Binghamton, N. Y.*



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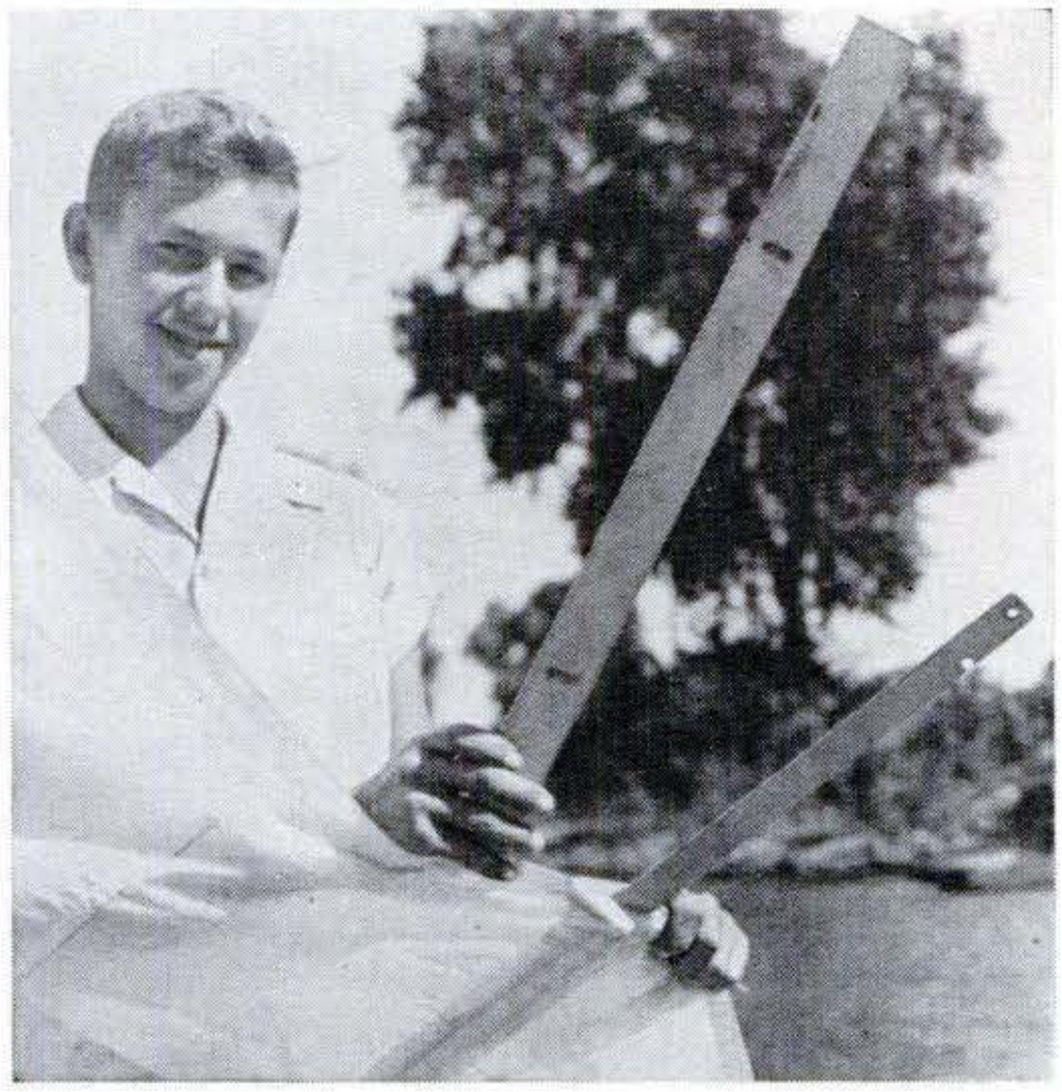
## Aircraft Fuel Tank Is Make-Believe Submarine

"WHEN are you going to submerge?" people shout at George Charles, of Akron, Ohio, when he explores the Portage Lakes in this 14-foot cigar-shaped boat. He made it out of a sectional aluminum aircraft fuel tank, and runs it with a 3½-hp. outboard motor. The strange craft has no keel, but is kept stable by weights (dirt-filled storage-battery cases) in the hull. The dome amidships holds a light for night fishing.

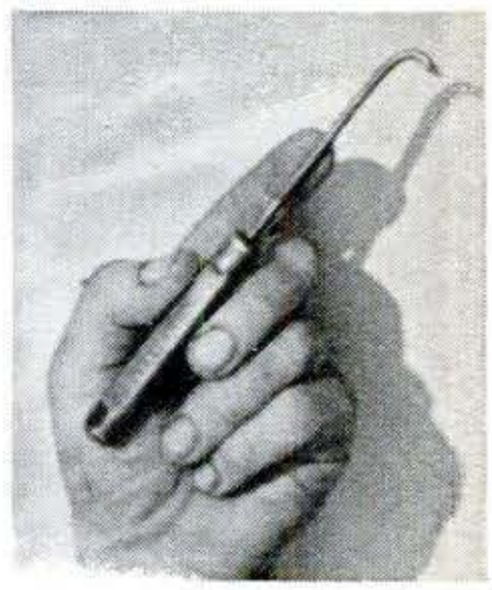


## Blind Slats Make Battens

OLD wooden Venetian-blind slats make excellent sail battens. Damaged or broken slats usually are available at little or no cost at Venetian-blind shops. Because the slats are flat, smooth, flexible, and straight-grained, they need only be cut to size and lightly sanded on the new edges.—*Tom Griberg, Moline, Ill.*

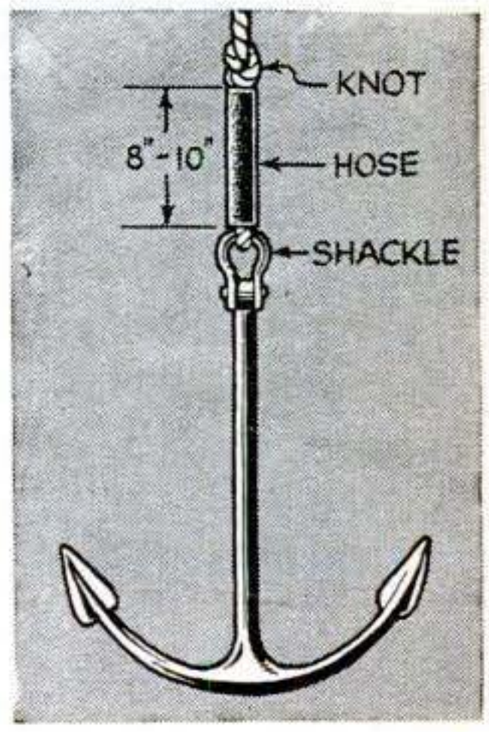
## Hook Removes Old Caulking

THE point of an ice pick, if blunted and bent into a hook, is an excellent tool for removing old caulking from the seams of small boats. The point may be filed flat on the inside of the hook. It should be pointed but not sharp. You may have to anneal the steel.—*C. R. Hull, Costa Mesa, Calif.*



## Hose Protects Gunwale

A LENGTH of garden hose, slipped over the anchor rope and fastened just above the shackle, acts as a fender to keep the shackle from scraping the gunwale. The hose also provides a grip for handling the anchor.—*S. P. Wiener, So. Norwalk, Conn.*



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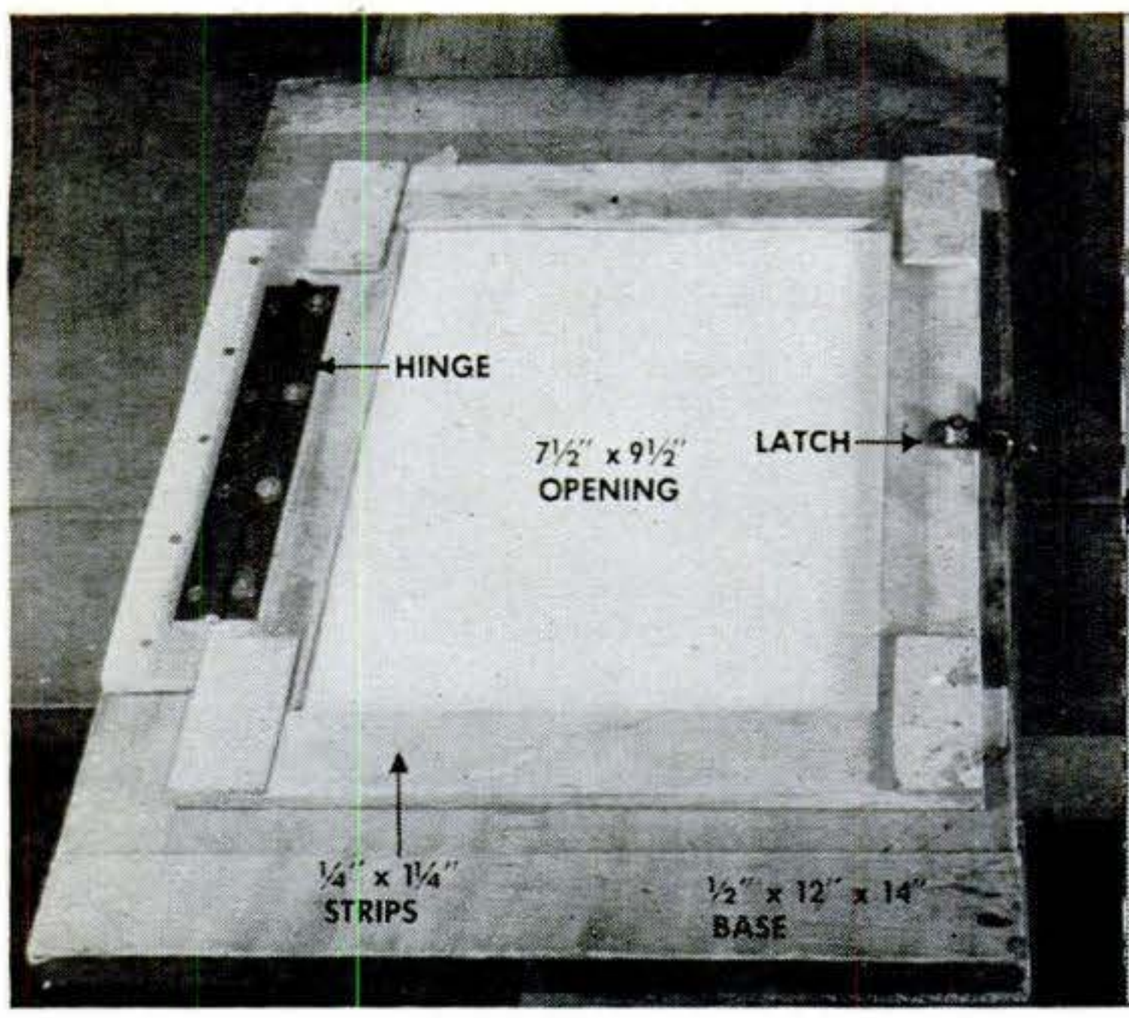
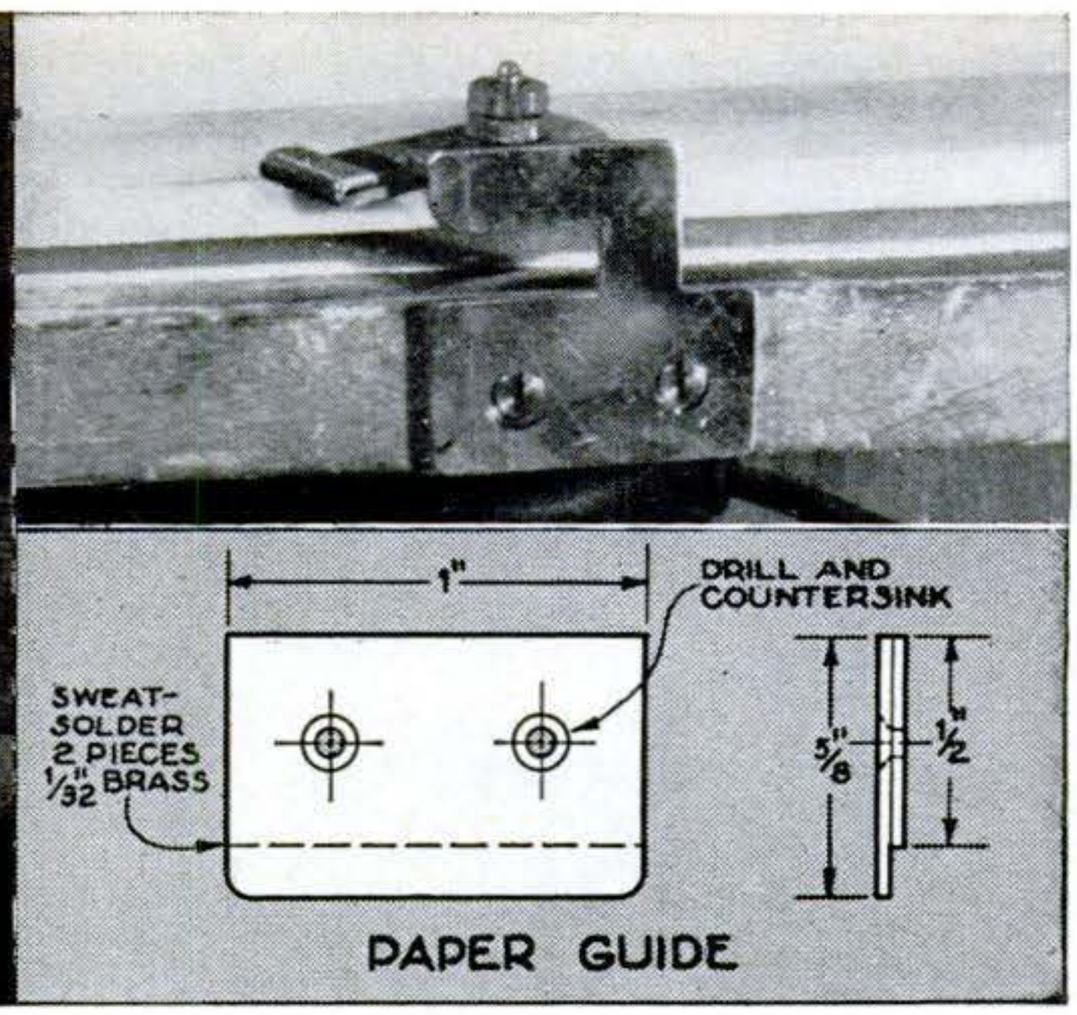


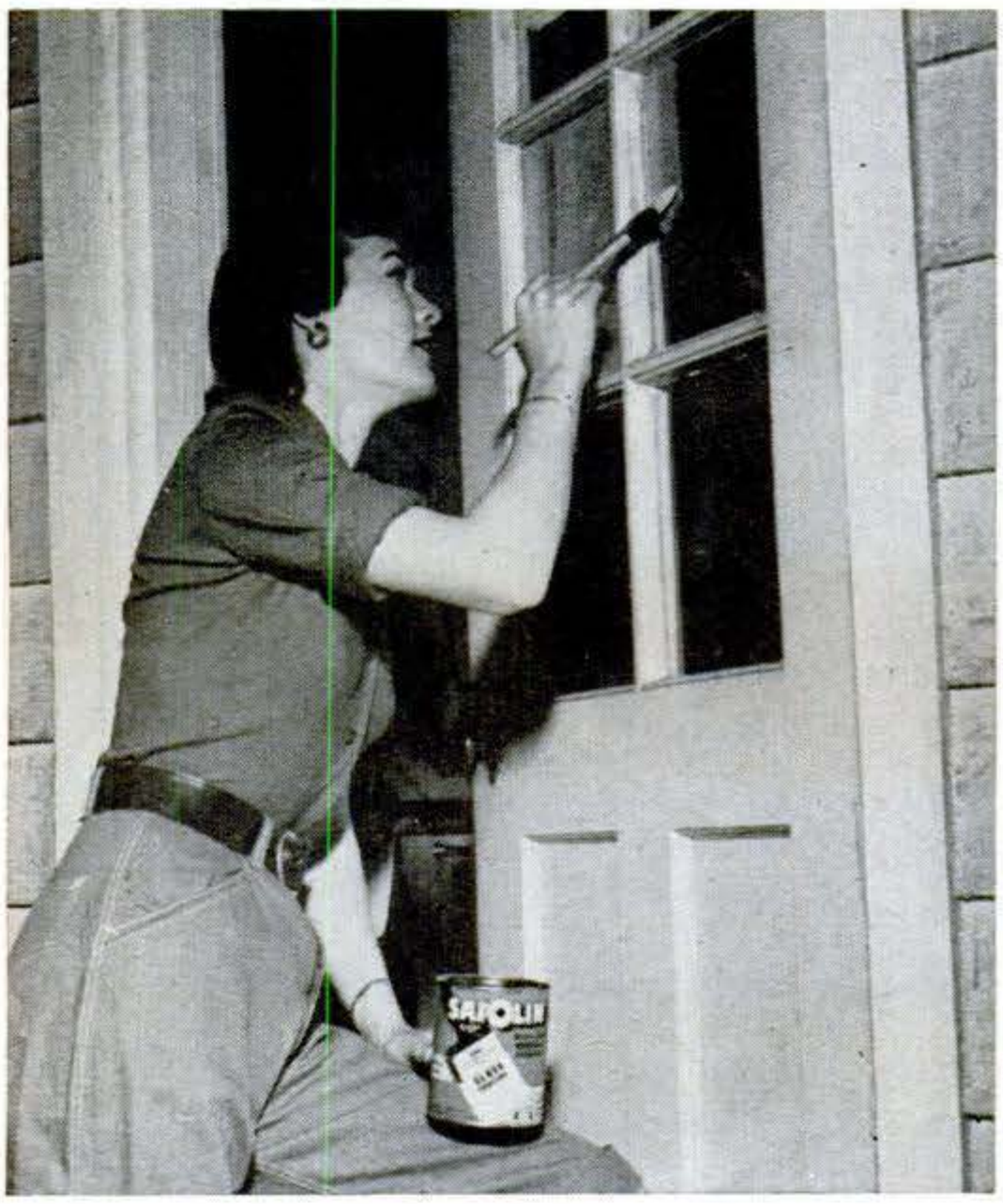




## Easel Speeds Photo Printing

AN EASEL is one piece of equipment on which the beginner in photography can easily save money. The one shown here is suitable for prints of only one size—8 by 10—but it costs little and can be quickly made.

You can use an old drawing board or a piece of plywood for the base. For the upper frame, be careful to choose strips with a straight edge. A 7½" by 9½" opening gives you prints with a ¼" border.

Make three paper guides from 1/32" brass. Screw these to the base, two along the hinge edge and one at an end. Chisel out shallow recesses in the frame to clear the guides. Make both parts of the latch from 1/16" sheet brass and mount them as shown in the photo.—*R. C. Collins, Jr., Elizabeth, N. J.*




## Paint Frosts Glass

BRUSHED or sprayed on clear glass, this paint gives the same effect as ground glass. Light can enter but you can't see through the glass. The finish is said to be elastic, permanent, and washable. Sapolin Paints, Inc., of New York City, prices the glass frosting at $1 a pint.

## *The Height of Ingenuity*

I needed a supply of water for a construction job at my summer home. The only hose available was far too short. So I made a hose. What do you think I used?

*I rounded up clothesline, a stapler, and a roll of kitchen waxed paper. The line was stretched between stakes and the waxed paper wrapped around it to form a tube. Staples every few inches held the tube together. It carried a steady flow of water perfectly.—L. A. Hart, Elmhurst, N. Y.*



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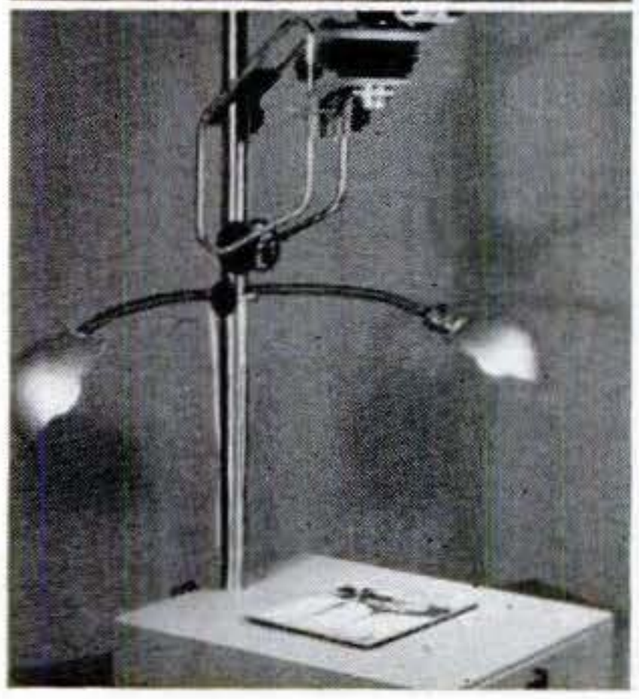
# IT'S THE NEW KODAK FLUROLITE ENLARGER

A magnificent enlarger that does many other jobs! Fluorescent circline lamp gives instant "on and off" cold light ... properly balanced for all color processes. "Integrating-sphere" type lamphouse and special inside coating give uniform light distribution; paper storage compartment in base of enlarger. Without lens, $112.50, including Federal Tax. 7 lenses available separately. See it at your Kodak dealer's.

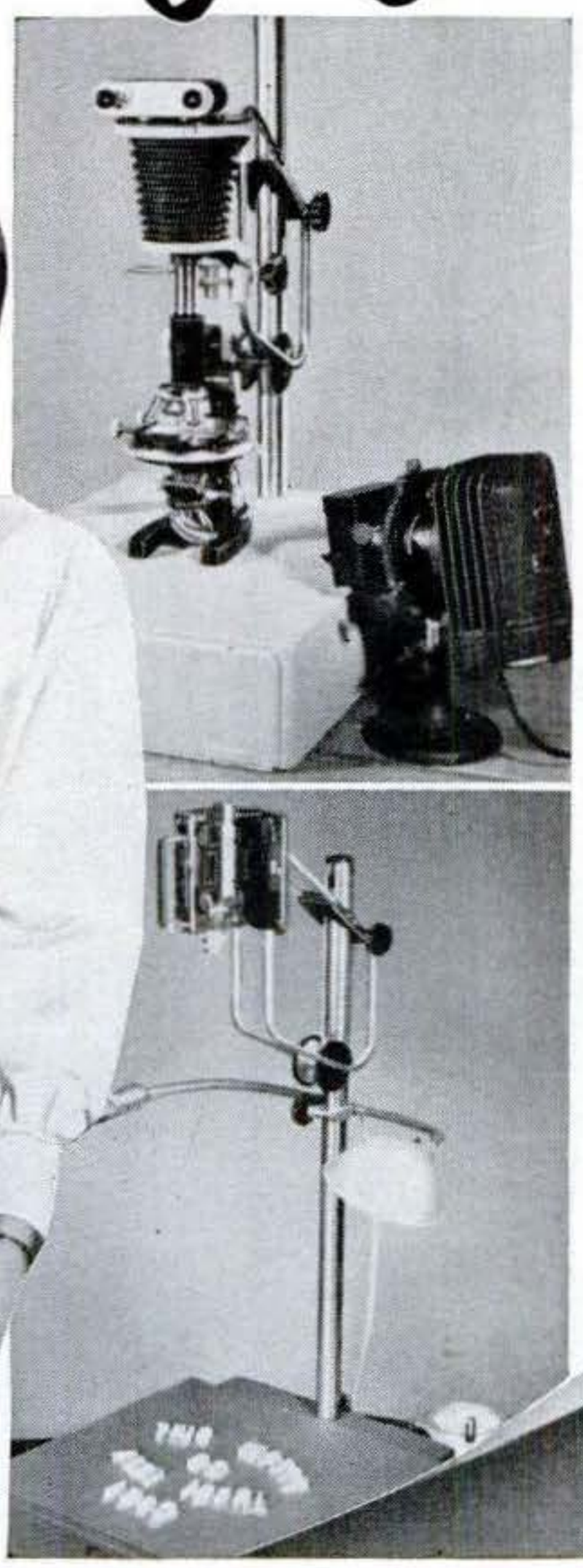
**EASTMAN KODAK COMPANY**
**ROCHESTER 4, N. Y.**

**A VIEW CAMERA . . .** the Kodak Flurolite Camera Bed and Camera Back Adapter A (used as accessories) give a sturdy setup for 2¼ x 3¼ pictures. Use Kodak 35mm. Film Adapter A for miniature color photography.



**COPYING AND CLOSE-UPS . . .** use the enlarger as a camera, with the accessory Kodak Copying Lights, Model 2. Fully adjustable.

## *Enlarging Plus...*



**PHOTOMICROGRAPHY, MICROFILMING, CLINICAL PHOTOGRAPHY . . .** in this illustration, the Kodak Microscope Attachment replaces the enlarger lens and makes a light-tight connection with the microscope.

**CINE-TITLING . . .** the inclined arm on the stand assembly supports a Cine-Kodak camera for making titles.

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Newer cars need only Simoniz to clean and beautify the finish in a single, simple operation. On older cars, first use Simoniz Kleener (Liquid or Paste) to clean the finish. Then Simoniz for lasting beauty. . . THE SIMONIZ COMPANY, CHICAGO 16, ILL.

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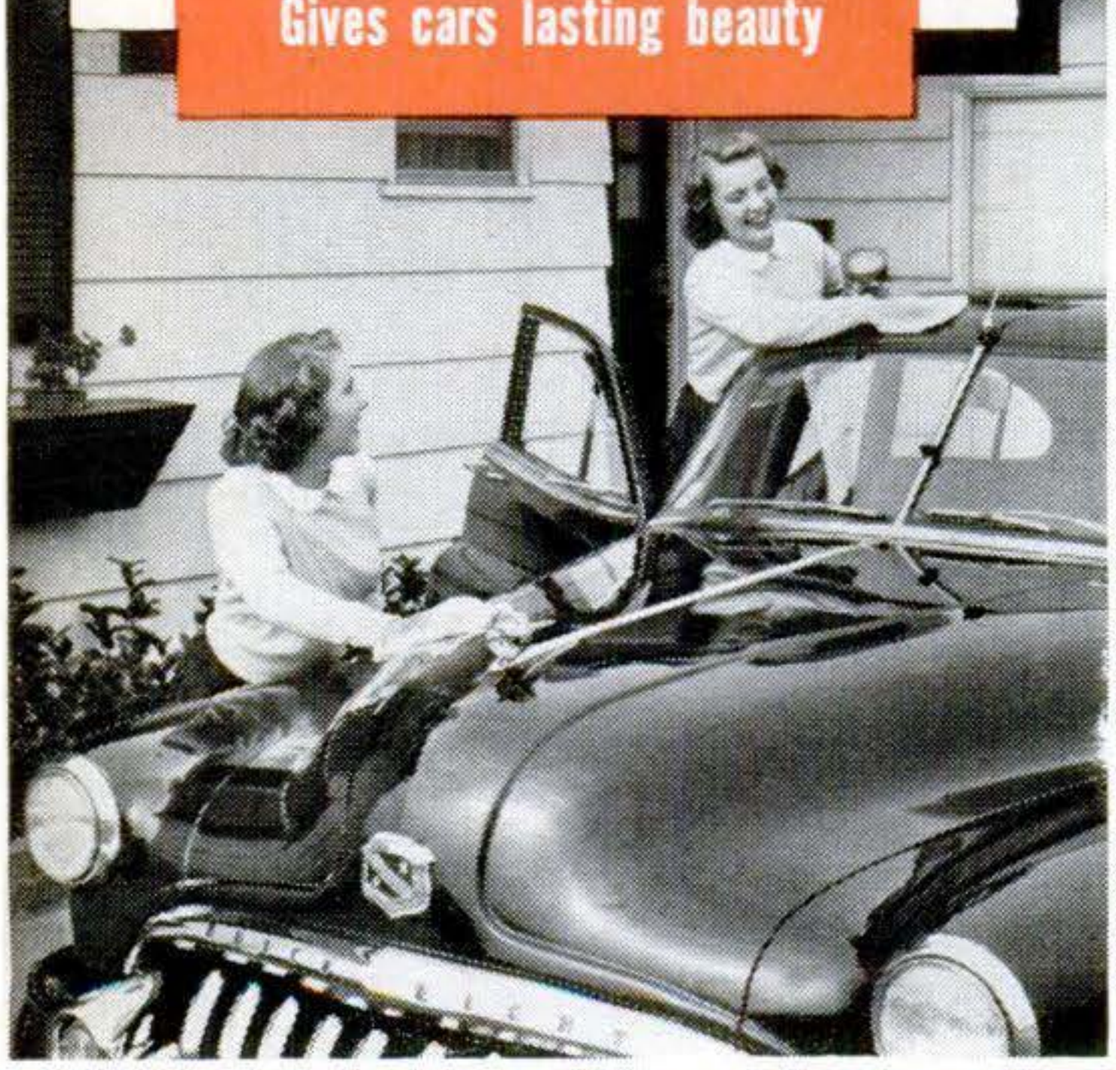


**The sooner you Simoniz your car the better!**

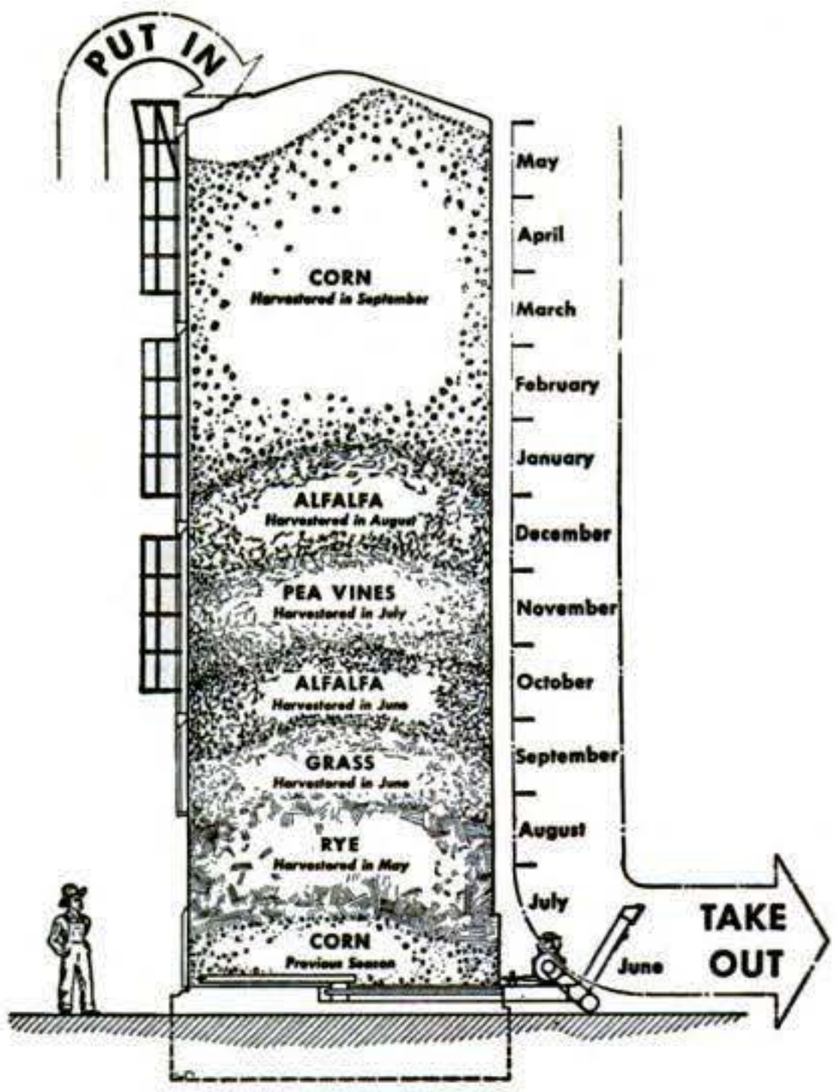

# *Mechanics of Farming*

**By Ladd Haystead**

■ Liquid Stainless Steel (Lockrey-Frater Corp.), applied by brush or spray, will be a boon to dairymen. The material is waterproof, resistant to most chemicals, flexible, and non-oxidizing. Treating milk-house walls and equipment with it should reduce bacteria count through more effective cleansing.

■ A farm-size rotary snow plow that throws snow to a maximum of 30 feet is announced as an attachment to the 6-horse Beaver tractor (Beaver Tractor Co., Stratford, Conn.).

■ A glass-lined silo is offered by A. O. Smith Corp., Milwaukee, Wis. It's 14 feet in diameter and 40 feet high, made of 45 sheets of




glass-surfaced steel that keeps out oxygen, cause of spoilage. A bottom unloader saves labor and the hazardous daily climb into the storage unit. Crops can be ensiled one on top of the other. Even grass silage -- one of the major advances in animal nutrition and cost cutting -- can be handled without seepage.

■ Hydraulic control of tractor-mounted implements has been with us for several years. But now comes a hydraulic cylinder that adjusts ma-



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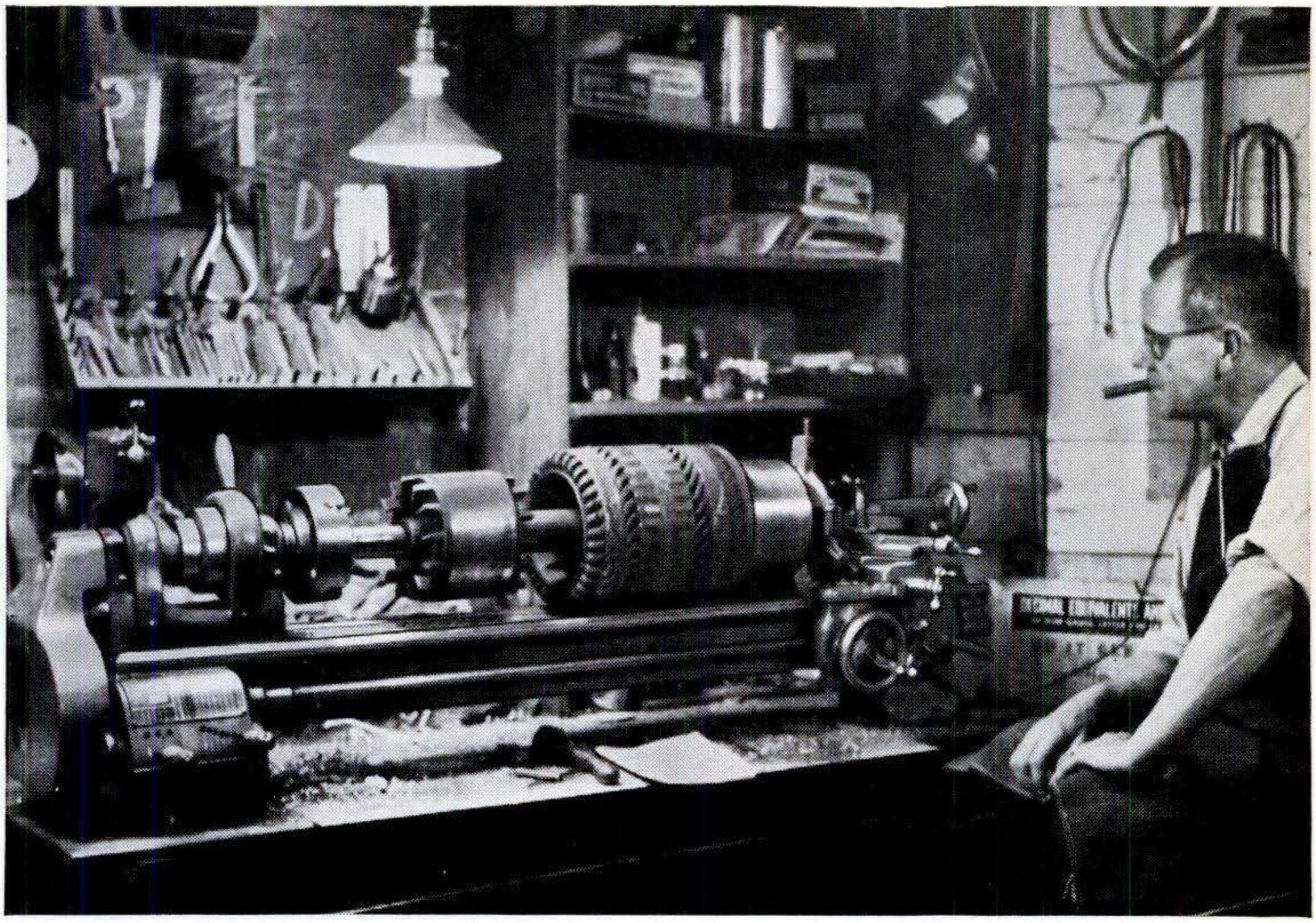

195 pound welder armature being machined in a South Bend 9″ Bench Lathe

# *Small Lathe Does Big Job*

***Unusual repair job demonstrates profitable possibilities for doing maintenance work in your home workshop.***

*Dewey Elmore, plant manager of the Hornaday Milk Co., Indianapolis, Indiana, recently sent us the picture reproduced above and the following letter.*

Gentlemen:
This picture was taken by my son who thought I was doing such an unusual job on a 9″ South Bend Lathe. The armature I was turning weighed 195 pounds, was 34″ long and 8½″ in diameter. The armature was out of a direct motor drive, 300 amp. D.C. welder, which had three armatures mounted on the same shaft, the drive motor armature, the main welding generator armature and the exciter generator armature. The shaft was broken between the two generator armatures and I was unable to get parts, as the welder was obsolete. If I had made a new shaft, it would have been necessary to have special jigs and fixtures to press armatures on and off. I supported end of armature shaft in steady rest and chamfered for welding, drilled ½″ hole in ½″ deep in main shaft. The stub shaft to be welded on was large enough to allow for warping. I chamfered this shaft leaving ½″ nub on end to drive in to hole in old shaft. After electric welding, I turned to size.

I am real proud of this job, and the welder is back in service as good as new.

I am employed by the Hornaday Milk Company. I have a No. 644-R lathe in my hobby shop at home in my basement and for the past several years have done about all the maintenance machine work for the milk plant.

Dewey Elmore

*How about the equipment in your shop? If you are interested in lathes, drill presses, or shapers, write for our catalog.*

South Bend Lathe Works
South Bend 22, Indiana



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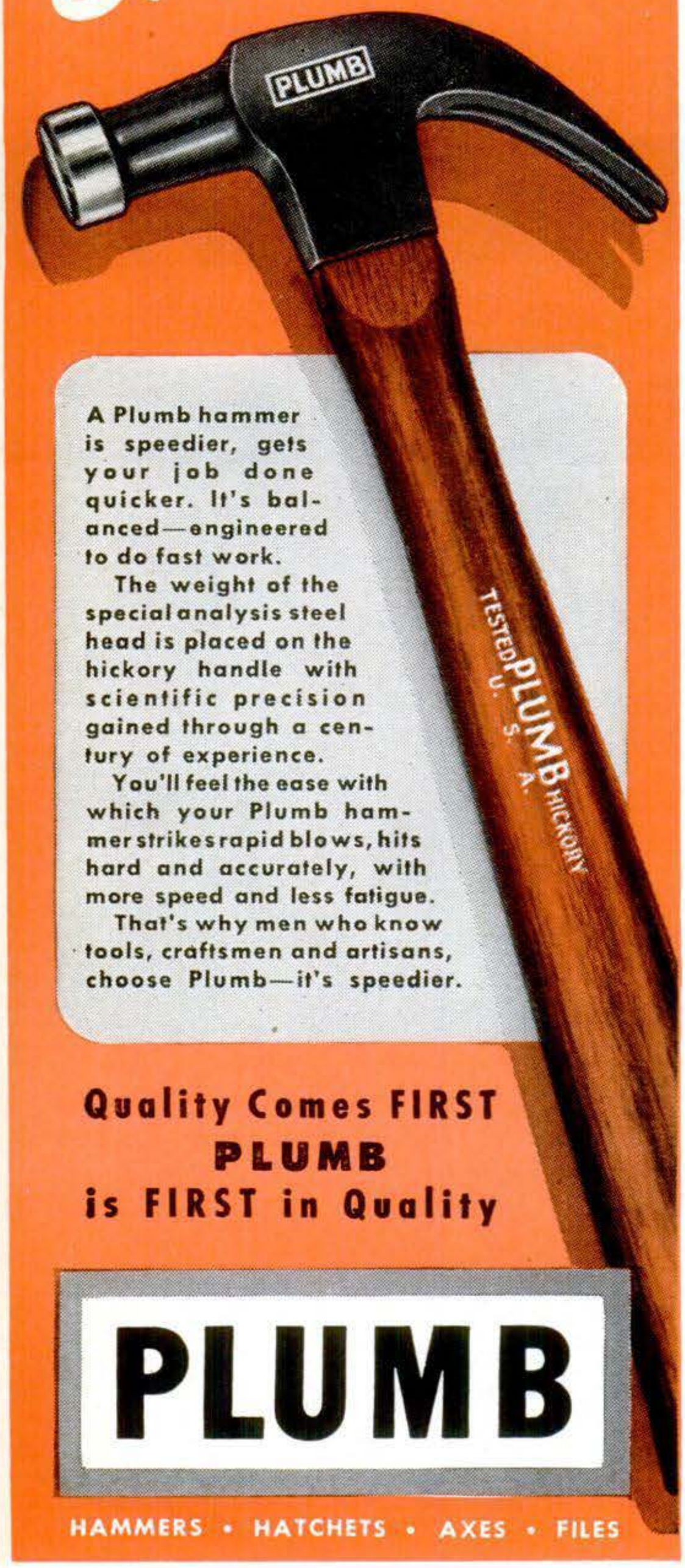
Speediest member of the animal kingdom is the Cheetah. In India it is used for the hardest kind of hunting. The Cheetah is turned loose from a moving car to overtake fast game like antelopes.

SPEEDIER




A Plumb hammer is speedier, gets your job done quicker. It's balanced—engineered to do fast work.

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You'll feel the ease with which your Plumb hammer strikes rapid blows, hits hard and accurately, with more speed and less fatigue.

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chines pulled behind the tractor. Any make of implement can utilize the device, and it can be transferred from one machine to another in minutes.

■ Reforestation on the large scale is now done by helicopter, using pelleted seeds.

■ The cheapest hired hand on the farm is electricity. Three out of four farms are now electrified -- a total of 4,582,016 -- according to Rural Electrification Administration. In 1935 only 10.9 percent were hooked up. More than 600 farm uses have been found for the juice.

■ A jeep and a trailer have mechanized the modern cowboy. No longer does he ride 15 miles to work. Instead, his horse goes in the trailer, himself in the pulling jeep, and both motor to the part of the range to be worked. Unfair to Hollywood, perhaps, but it enables a man and horse to cover much more ground.

■ Two tons of carbon black, by-product of natural gas, mixed in the top two inches of soil, raises soil temperature by several degrees, the oil industry recently announced. This could open the spring season earlier and extend the fall growing period, with consequent yield increases.

■ Heifers can be brought into milk without first having a calf, experiments at the New Jersey station have shown. Thyroprotein is the substance that turns the trick. This may become widely useful as a treatment for sterility.

■ Farmers owned (1949) 5,332,000 passenger cars, 2,400,000 trucks, 3,375,000 tractors, and are spending over 3 billion dollars a year for motive power and implements of all kinds.

■ Plowing, disking, harrowing in one operation is claimed for the Clodbuster (Valley Mfg. Co., Valley, Neb.), a new rotary plow-harrow. Fuel and time savings up to 66 percent are possible.



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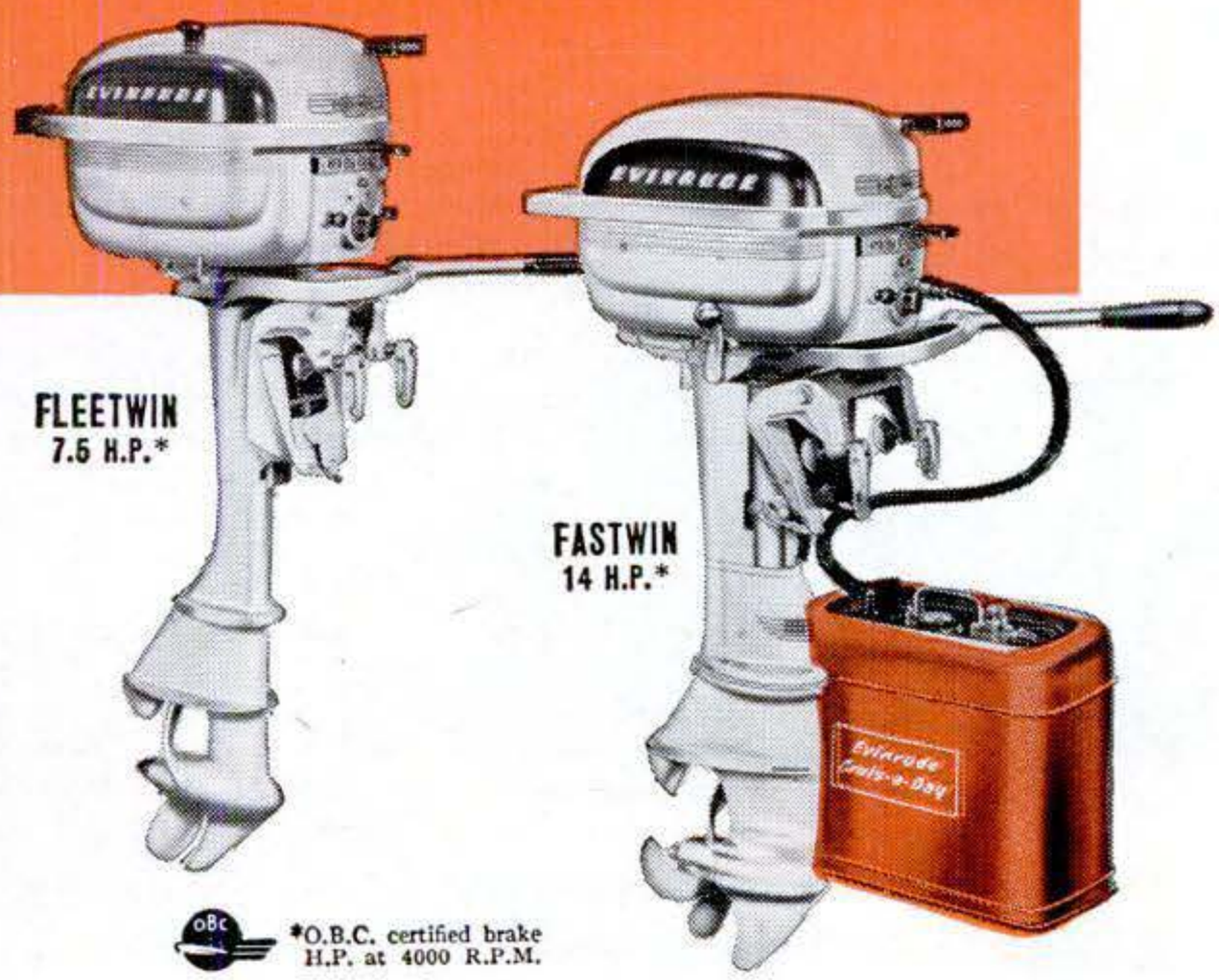
# *what a difference* in Boating Fun

## *with* DUO-CLUTCH

You start in *Neutral* and idle when you like . . . *what a difference!* No fuss when you get underway ! Load passengers and fishing gear. Then "press the button" and head for fun ! Open the throttle and thrill to the performance of a motor that's ALL NEW . . . packed with power . . . wonderfully smooth right down to mile-an-hour trolling speed ! New FLEETWIN with *Duo-Clutch* weighs only 45 pounds, develops 7.5 certified horsepower.*

## *with* GEARSHIFT

*What a difference* . . . when there's *Gearshift Control* at your fingertips . . . with *Neutral-Forward-Reverse* to give you new starting ease—new maneuverability—new handling convenience ! Enjoy the difference . . . with *Gearshift Control* in the great new Evinrude FASTWIN ! 14 horsepower* for superb performance on fast boats. With separate 6-gallon *Cruis-a-Day Tank* that gives you hours and hours of running without refueling.

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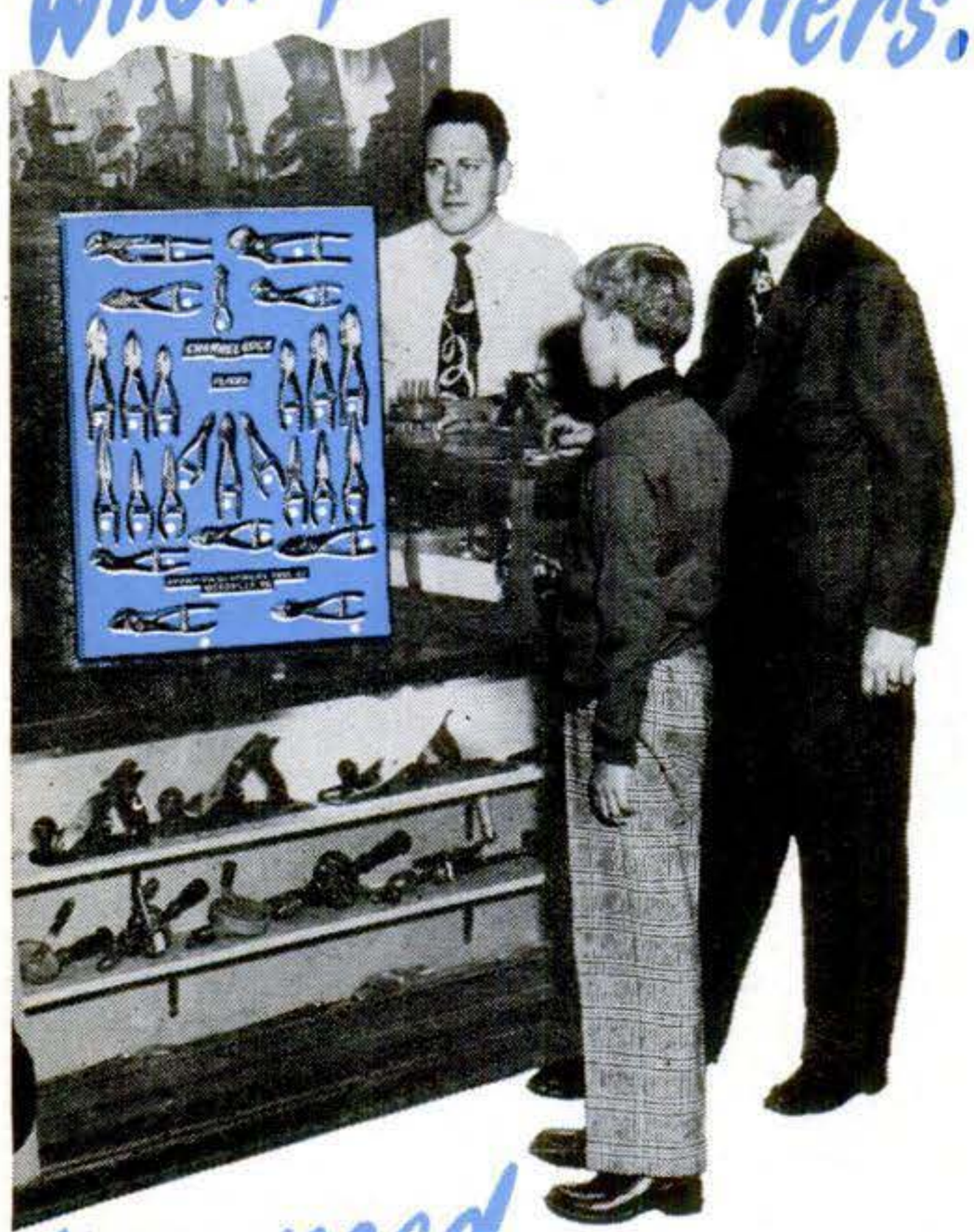

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# Air Force Offers Films For Free Showings

THE U. S. Air Force has many 16-mm. sound films available for nonprofit, non-theatrical, educational showings. The following titles are among those that may be borrowed from the Public Information Officer of the Air Materiel Area Headquarters nearest you. Last month PS published (p. 244), a similar list of available Navy films. A subsequent issue will list films from the Army.

"AAF Comes of Age." Film shows development of the Air Force from the period before Pearl Harbor to the dropping of the atom bomb on Hiroshima and Nagasaki. It is illustrated by combat scenes. Black and white. Running time about 50 minutes.

"Air Chaplain." This shows the human and spiritual relationship of the chaplain with Air Force personnel. Both religious and other activities of the chaplain are portrayed. Black and white. Running time about 15 minutes.

"Air Progress." This is a documentary film of the Air Progress Demonstration that was presented at the request of Congress for its members, the press, and the President and his cabinet. Static exhibits show the progress made from the earliest to the most modern airplanes. The President witnesses a review of Air Force planes. The Thunderbolt, Mustang, Flying Fortress, Superfortress, Shooting Star, Flying Wing, and B-36 are among the airplanes shown in flight. Black and white. Running time approximately 12 minutes.

"Air Pattern Pacific." A story of the 13th Air Force, its operations against the Japs, rescues at sea, fights against malaria. Black and white. Running time 42 minutes.

"Basic Electricity." A training film suitable for students. Color. Running time approximately 20 minutes.

"Basic Electronics." A training film suitable for students. Color. Running time approximately 17 minutes.

"China Crisis." Film shows newsreel shots made by combat camera crews. A story of the 14th Air Force's struggle to support the Chinese Army against the onrushing Japanese during the spring and summer campaigns of 1944. Black and white. Running time approximately 45 minutes.

"D-Day Minus One." Story of paratroops and glider crews who went into France ahead of the main invasion forces, spearheading the attack. Black and white. Running time about 20 minutes.

"Dividends for the Future." Picture shows the benefits derived by the public through the development of civilian by-products of the Air Force Research and Development program. Examples of the benefits gained are GCA, electric blankets, fabrics, precision cameras, etc. Black and white. Running time about 18 minutes.

"Do You Know What the Army Air Force Is?" This is a musical short conveying the idea that the Air Force belongs to all people and is composed of all the people of America. The Air Force's male chorus is featured. The musical arrangement is by David Rose. Black and white. Running time approximately 8 minutes.

"Fight for the Sky." This film illustrates the use of fighter aircraft in clearing the sky of the Luftwaffe and clearing the roads, railroads, and waterways for oncoming



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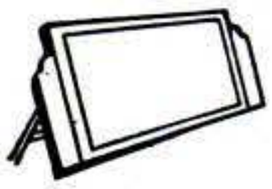
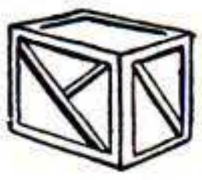
# Big table — big cut — small floor space



*. . . For sign shops*

*For maintenance departments . . .*



*. . . For shipping departments*

*For carpenters . . .*

*. . . For hobbyists*

*For **everybody** who cuts wood!*

## *Quality 8" Tilting-Arbor Saw — accurate, safe, economical*

Everything you look for in a circular saw. Unsurpassed Delta quality — your assurance of long-time, trouble-free performance. Compact floor model. Cuts full 2-5/16" thick. Big cast-iron table. Features include: Lubricated-for-life ball bearings. Full-length rip fence. Adjustable table insert. Auto-Set miter gage. "Super-safe" saw guard. See this Delta-Milwaukee 8" Tilting-Arbor Saw today! HM-79

Look for the name of your Delta dealer under "Tools" in the classified section of your telephone directory.

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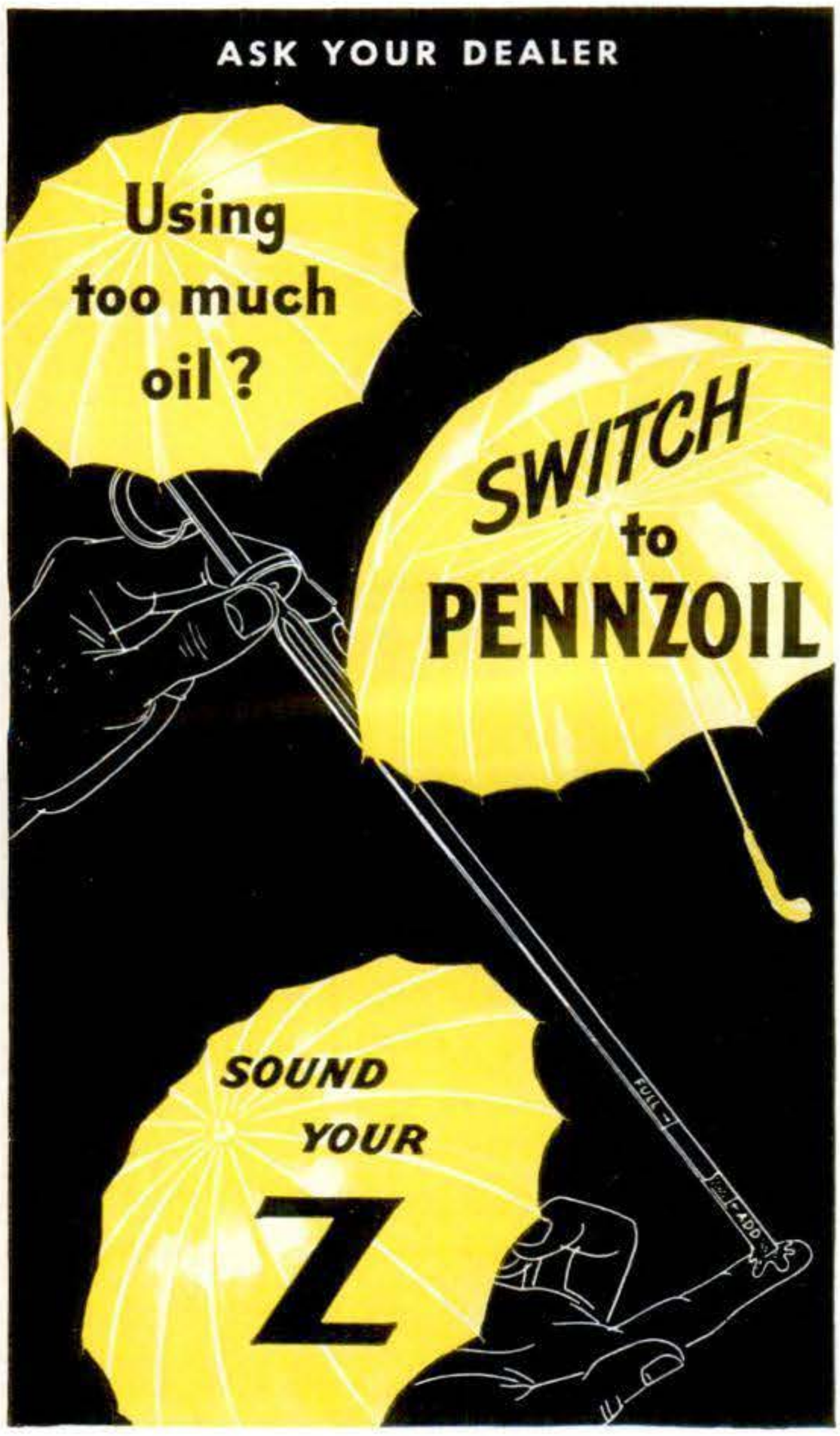


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Allied Ground Forces. Black and white. Running time about 20 minutes.

"Idlewild—New York International Airport." This is a documentary film showing the opening of the International Airport at Idlewild, New York. Air Force and Navy demonstrations include formation flying and other feats. Black and white. Running time 8 minutes.

"Know Your Air Force Better." This motion picture takes you on a visit to an Air Force base to see all kinds of demonstrations and types of airplanes. Black and white. Running time about 15 minutes.

"New Wings for Peace." Highlights of the Aviation Cadet program are shown in this film. The career of a young man with a two-year college background is traced, showing his progress through advanced training and graduation at Randolph Air Force Base. Some of the Air Force's jet aircraft are also shown. Black and white. Running time about 10 minutes.

"Operation Vittles." This film explains how the Berlin airlift worked. Supplies are shown being loaded and delivered to Berliners under good and bad weather conditions. Operation Little Vittles, in which Berlin children play airlift, eagerly awaiting candy dropped by handkerchief parachutes, is also shown. Black and white. Running time about 15 minutes.

"Paricutin." This famous Mexican volcano is shown in all its frightening glory. The Air Force flies a helicopter over lava and crater to carry a scientist to areas otherwise inaccessible. Black and white. Running time about 15 minutes.

"Salute to the Ladies." A film tribute to WACS, WASPS, and Flight Nurses, showing the important role they played in the war. Black and white. Running time approximately 18 minutes.

"Sustained Operations." A B-29 squadron arrives at Okinawa to go on maneuvers. The big Superfortress that blasted the Japanese homeland returns to the Pacific area on a peacetime practice mission. Black and white. Running time about 10 minutes.

"The Memphis Belle." This is the story of a Flying Fortress. Color. Running time approximately 42 minutes.

"Target for Today." A film depicting the effectiveness of strategic bombing upon the German industrial empire and the Luftwaffe's withdrawal from offensive action. Black and white. Running time about 93 minutes.

"Target Invisible." A film illustrating the use of a radar scope on a mission over Japan. Black and white. Running time about 8 minutes.

"Target Tokyo." This picture follows a B-29 crew from its training in Grand Island, Nebraska, to a mission to Tokyo. Black and white. Running time about 20 minutes.

"That Men May Fly." This motion picture is based on the activities of the Office of the Air Surgeon and shows the work of both the School of Aviation Medicine and the Aero Medical Laboratory. The film shows how airmen are given best protection and care that science can provide. Black and white. Running time about 28 minutes.

"The Third Pillar." A film about the Aviation Engineers. Black and white. Running time approximately 18 minutes.

"Victory in the Air." This film gives General Arnold's report to the people. It shows how material produced by war workers was utilized by the Air Force in Europe and the Pacific. Black and white. Running time approximately 15 minutes.



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# Wonderful fun—
## ENDLESS GOOD TIMES

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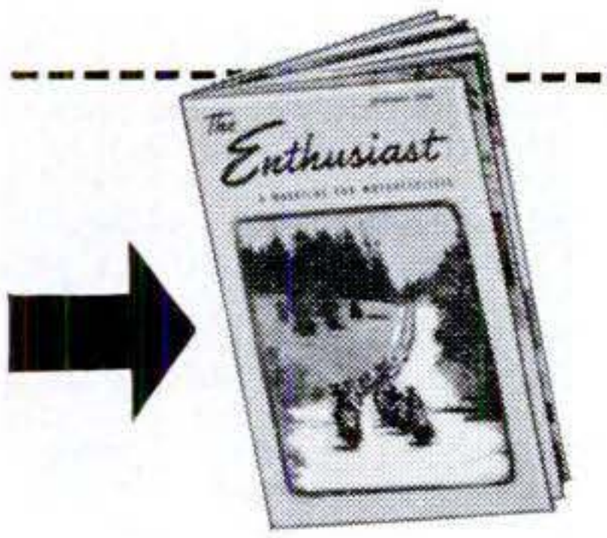
## HYDRA-GLIDE

NEW pleasures await you in motorcycling, world's greatest sport! Adventure, travel, thrills, fascinating friends! Every trip is delightfully different, every moment one to be remembered as you take in exciting races, hillclimbs, endurance runs and go on gypsy tours, sightseeing trips and other club events.

And what a difference it makes when you're riding a Harley-Davidson *Hydra-Glide!* Roughest roads smooth out like magic, hills fade away, day-long riding is really comfortable! Get your share of this exhilarating fun. You can own a Harley-Davidson on easy terms. See your dealer today.

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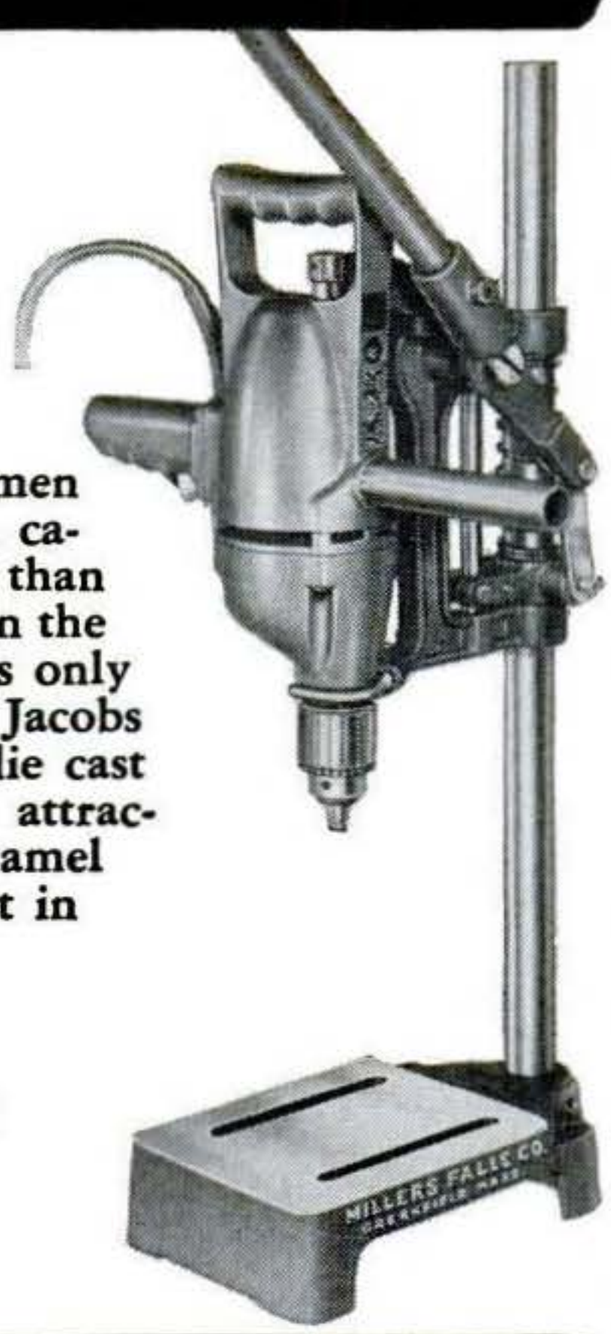
**A FISTFUL** of power, this new streamlined beauty makes light work of hundreds of jobs. Drills fast and true. Also swell for wire brushing, polishing, grinding, buffing,

**No. 914**
**¼-inch Drill**
**$19.85**

## MORE POWER TO YOU CRAFTSMEN

That's just what you get in Millers Falls new Utility Drills. Electrically and mechanically, they are the last word in modern design—engineered for the particular requirements of craftsmen, farmers, home workshop owners and repair shop men. They're lighter, more powerful, better built. Best of all, they're Millers Falls and the biggest dollar values of any drills ever made. Ask for them at your hardware dealer's.

**No. 912**
**½-inch Drill**
**$35.00**



**A RUGGED HUSKY** for men who want full ½-inch capacity. More powerful than any comparable drill on the market — yet it weighs only 8 lbs. Genuine No. 33B Jacobs Key Chuck. Smooth die cast aluminum frame and attractive grey hammered enamel finish. It's the standout in its class!

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Provide more usable space in your home by turning a large room into two smaller ones. For example, partition off a large double parlor into two rentable bedrooms or a small apartment. You can do it easily at low cost with Gold Bond Gypsum Wallboard. Nail the sturdy fireproof panels to a 2 x 4 framework. Seal joints with Gold Bond Tape Joint System and paint with Gold Bond Sunflex—the one hour wall paint. Or, if you prefer, Gold Bond Gypsum Wallboard takes wallpaper or texture beautifully. For further information, write Div. W, Dept. PS-4a.

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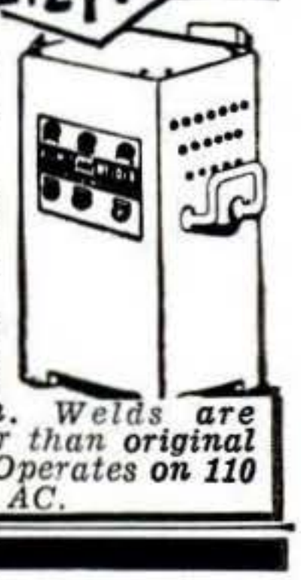

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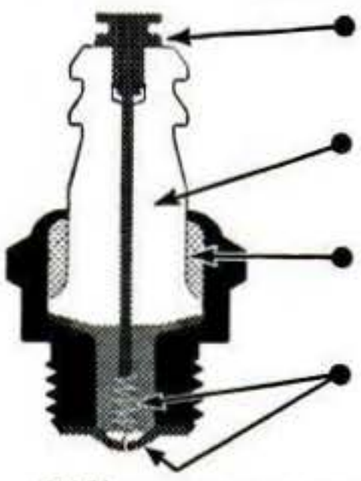
**for model engines only**



- **CHAMPION TERMINAL**—assures better center electrode seal and provides sturdier electrical connection.
- **CHAMPION-CERAMIC INSULATORS**—proved dependable in millions of Champion Spark Plugs.
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- **CHAMPION "THERM-O-FLEX" CONSTRUCTION**—longer element life, more dependable performance.

Follow recommendations of plug types and fuels approved by engine manufacturer.

**CHAMPION SPARK PLUG COMPANY, TOLEDO 1, O.**




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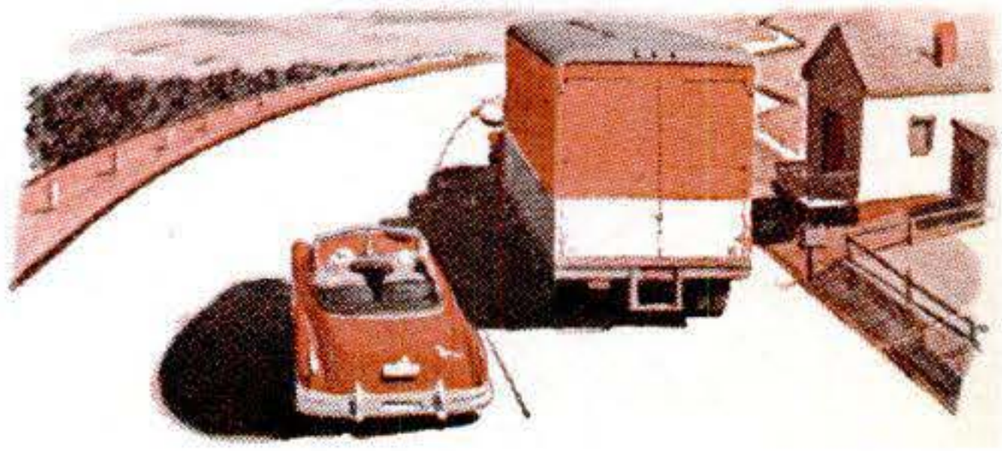
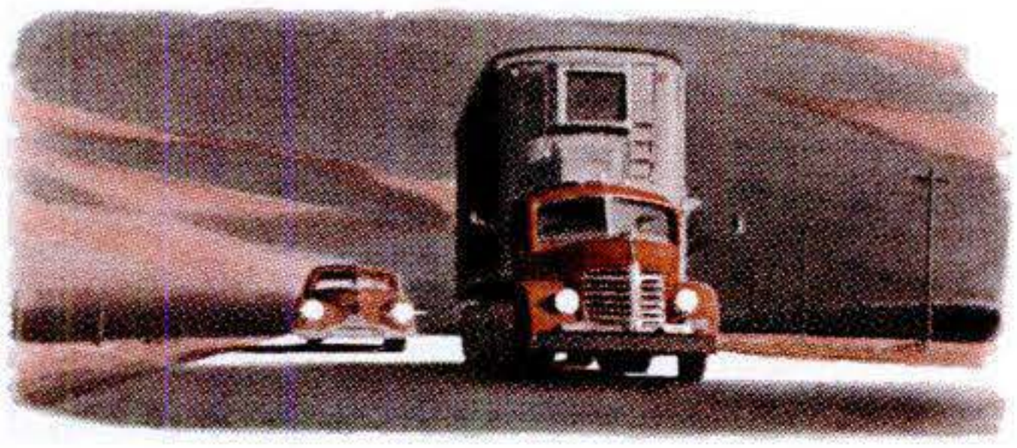
# BE A CHAMPION DRIVER

## COOPERATE WITH THE WORLD'S SAFEST DRIVERS—THE CROSS-COUNTRY TRUCKERS

When you're not certain that it's safe to pass a truck, give him a couple of short "toots" or blink lights at night. *Stay back.* He'll signal you — **when it's safe to pass!**



If you start by a truck and the driver waves you back, he's warning you that there's danger ahead! Stay behind until he signals that all is clear. **That's the safe way!**



If you are driving slowly and a truck passes *you*, flick your lights as soon as the rear end is clear of your car. This signal tells the driver that he can turn back into the right lane. **He'll appreciate this courtesy!**

Whenever you are *obviously* in distress on the road, you'll find the cross-country trucker will be the first to offer you expert help. You can repay this courtesy by always cooperating with him. **Be a Champion driver! It pays!**

Commercial truckers constantly make comparative tests of spark plugs because they know that good spark plugs maintain engine efficiency, economy and dependability. The fact that the vast majority use dependable Champion Spark Plugs is positive proof that you can save money with Champions in your car.

***. . . BE A CHAMPION DRIVER — IT PAYS!***

***FOLLOW THE EXPERTS-***

*Demand*

Mr. Jess L. Osburn, Houston Transit Company's superintendent of equipment, writes: "*We use dependable Champions exclusively. They helped us win the 1948 National 'Bus Transportation Maintenance Award' in the 501 to 750 bus group.*"

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SPARK PLUGS

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Ideal for nearly all finishes


Durable bristles... won't break off

When you ask for a paint brush, ask for a NYLON . . .

Nylon paint brushes are made by leading paint brush manufacturers. Sold in paint, hardware and wallpaper stores everywhere, in all popular sizes. Buy a nylon paint brush today!

NYLON PAINT BRUSHES

*for smooth painting ...easy cleanup*

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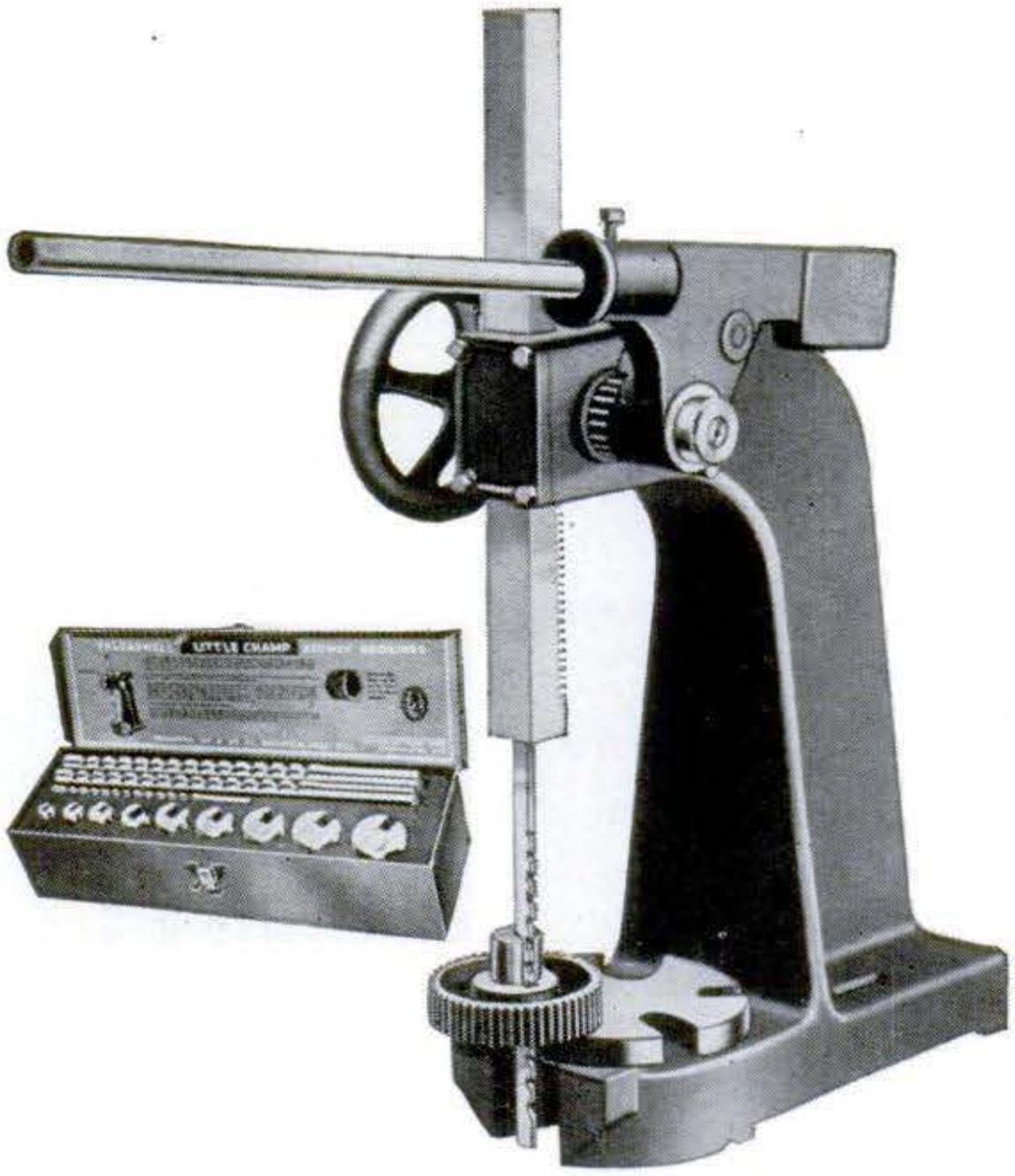

**Broach and Bushing Cut Keyway.** Inside keyways can be cut quickly to standard widths and any depth with the broach sets manufactured by Threadwell Tap and Die Co., Greenfield, Mass. In operation, a bushing is selected to fit the bore of the work. Then the broach is inserted in the bushing slot and forced through under a press. The first cut is made with the broach alone. To finish the keyway to the required depth, shims are placed behind the broach and successive passes made. The broaches are designed for use on steel and cast iron. If used on brass or similar soft metals, the 7° rake should be ground off to prevent hogging.

**Selector Holds Dial Gauges.** Designed as an aid to users of dial indicators and gauges, this unit provides a selection of 14 frequently used standard and special points. They all have a 4-48 mounting thread. The points are mounted in tapped holes on an aluminum ring with the size or number stamped on the ring. The points are made from steel, hardened, ground, and chrome-plated. A shock-absorbing point with an internal spring is included. The L. S. Starrett Co., Athol, Mass., prices the set at $11.50.

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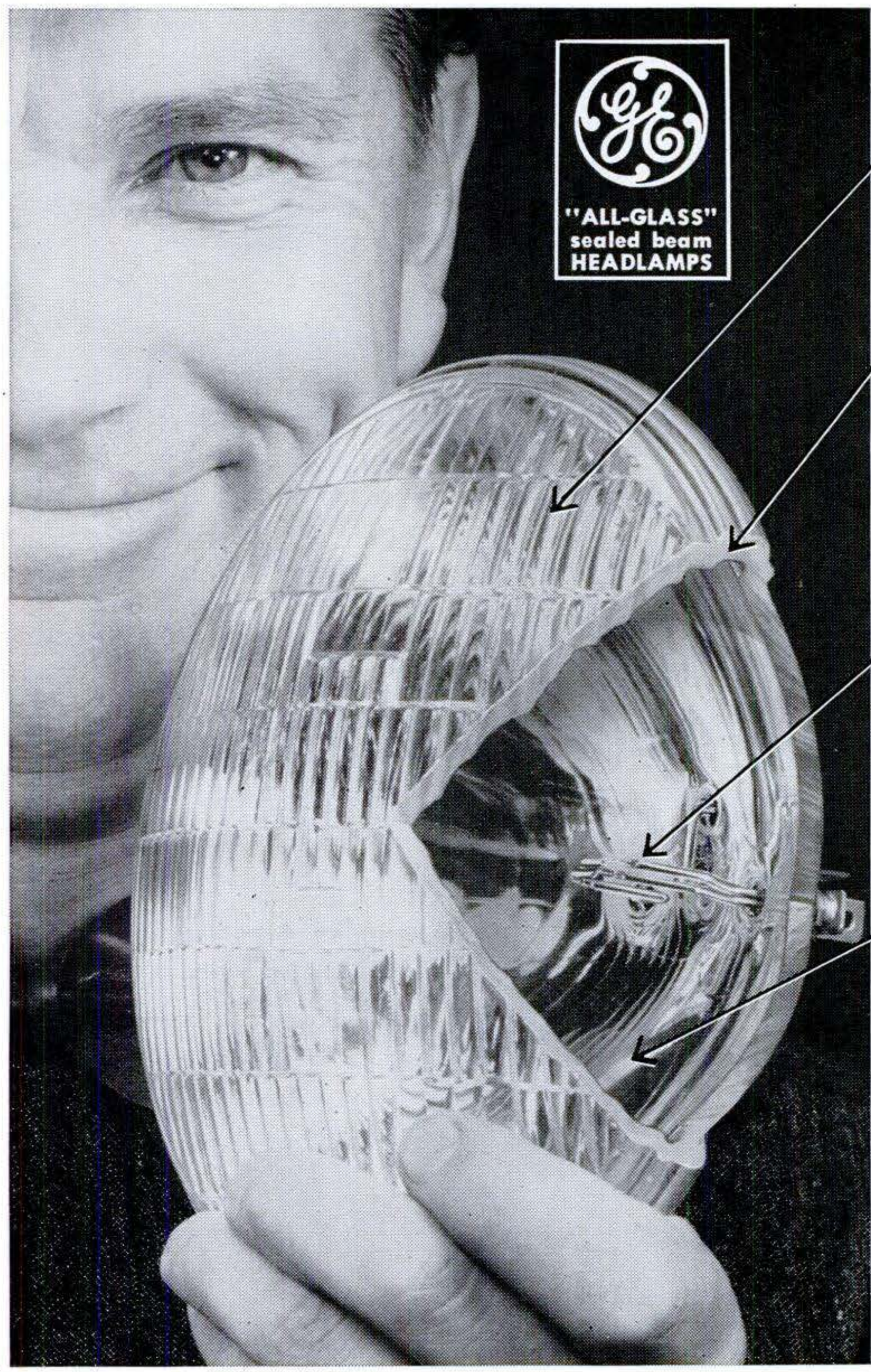
# Cutaway shows you why G-E headlamps do not grow dim:




**1 LENS** is made of shock-resistant hard glass, precision built to put maximum light on the road.

**2 ONE-PIECE "ALL-GLASS" CONSTRUCTION** keeps out all light-dimming dirt and moisture. The average General Electric headlamp gives 99% of original light output even at the end of lamp life.

**3 FILAMENTS** are held in vise-like grip — can't shake loose on rough roads. They give 12% more light on the road for driving — 16% more light for passing.

**4 MIRROR-LIKE REFLECTOR** stays bright for life; no dirt or moisture can get in to tarnish it.

*NOTE: Have lights checked next time you leave car for service, and insist on G-E!*

*You can put your confidence in—*

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**Portable Electric Saw.** This low-cost portable saw, made by Skilsaw, Inc., of Chicago, bevel-cuts and also adjusts for depth of cut. The price is about $60. It bevel-cuts up to 45° and saws stock up to 1⅞" thick. A wide variety of blades and abrasive wheels are available for cutting wood, metal, and composition materials such as wallboard or tile. It has a free blade speed of 5,800 r.p.m.

**Alcohol Blowtorch.** A built-in stand to let this torch rest in various positions on a bench, flame temperature of 2,700° F., and a sliding windshield for outdoor use, are features of this pistol-grip torch. It is made by the Lenk Manufacturing Co., of Boston.



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# You're driving into the Danger Zone

**WARNING ZONE**

**Engine loses pep . . .**

**Needs a tune-up**

Clean, adjust and re-time ignition. Clean fuel supply and carburetor screens. Adjust carburetor. Adjust tappets and fan belt. Check compression and vacuum readings for symptoms of ring wear.

**DANGER ZONE 1**

**Engine begins to smoke . . .**

**Needs new piston rings and minor engine repairs**

Replace piston rings. Align rods. Adjust rods or replace rod bearings. Reseat and reface valves.

Tune engine.

These repairs are comparatively inexpensive and put the engine back in peak condition for thousands of economical miles. Delay puts the engine in Danger Zone 2.

**DANGER ZONE 2**

**Engine pumps oil badly . . .**

**Needs new piston rings and major engine repairs**

Replace piston rings. Replace piston pins. Adjust—probably replace—main bearings. Align rods. Adjust rods or replace rod bearings. Reseat and reface valves. Tune engine.

These repairs naturally cost more than those needed in Danger Zone 1, but they put the engine back in condition for thousands of additional miles of satisfactory service. Delay leads to costly Danger Zone 3.

**DANGER ZONE 3**

**Destructive wear sets in . . .**

**Needs new piston rings and complete overhaul**

Repairs cost three or four times as much as in Danger Zone 1.

Remove engine. Rebore cylinders. Replace pistons, pins, rings. Replace main bearings. Align rods, refit or replace rods, or replace rod bearings. Overhaul valve lifters, rocker arms. Replace timing chains or gears. Reseat, reface valves. Replace guides and springs. Replace camshaft bearings. Clean oil lines. Overhaul oil pump.

Clean, re-install and tune engine.

***he more you delay-the more you pay!***

## Piston rings should be replaced ... *at the first sign of wear!*

**You'll be money ahead if you replace your piston rings when your car first gets into the Danger Zone. But if you delay until the second or third Danger Zone, repairs cost two to four times as much.**

**In *any* Danger Zone, ask your motor service man for Hastings Piston Rings. They *stop* oil-pumping, *check* cylinder wear and *restore* performance.**

**It's the best money you can spend on your car.**

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A short, strong, sturdy set. Each tool has two wrench sizes. Set ranges from 5/16" to 3/4". Durable polished chrome finish. In kit bag.

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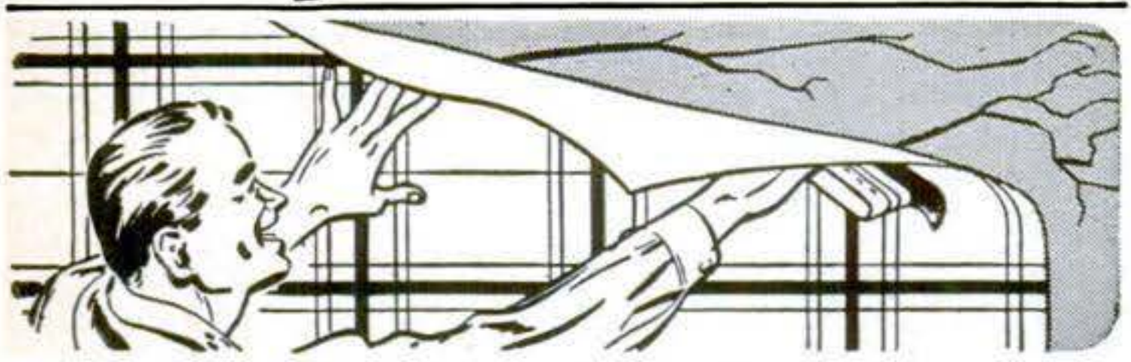

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Please send me, free, "How to Hang Sanitas."

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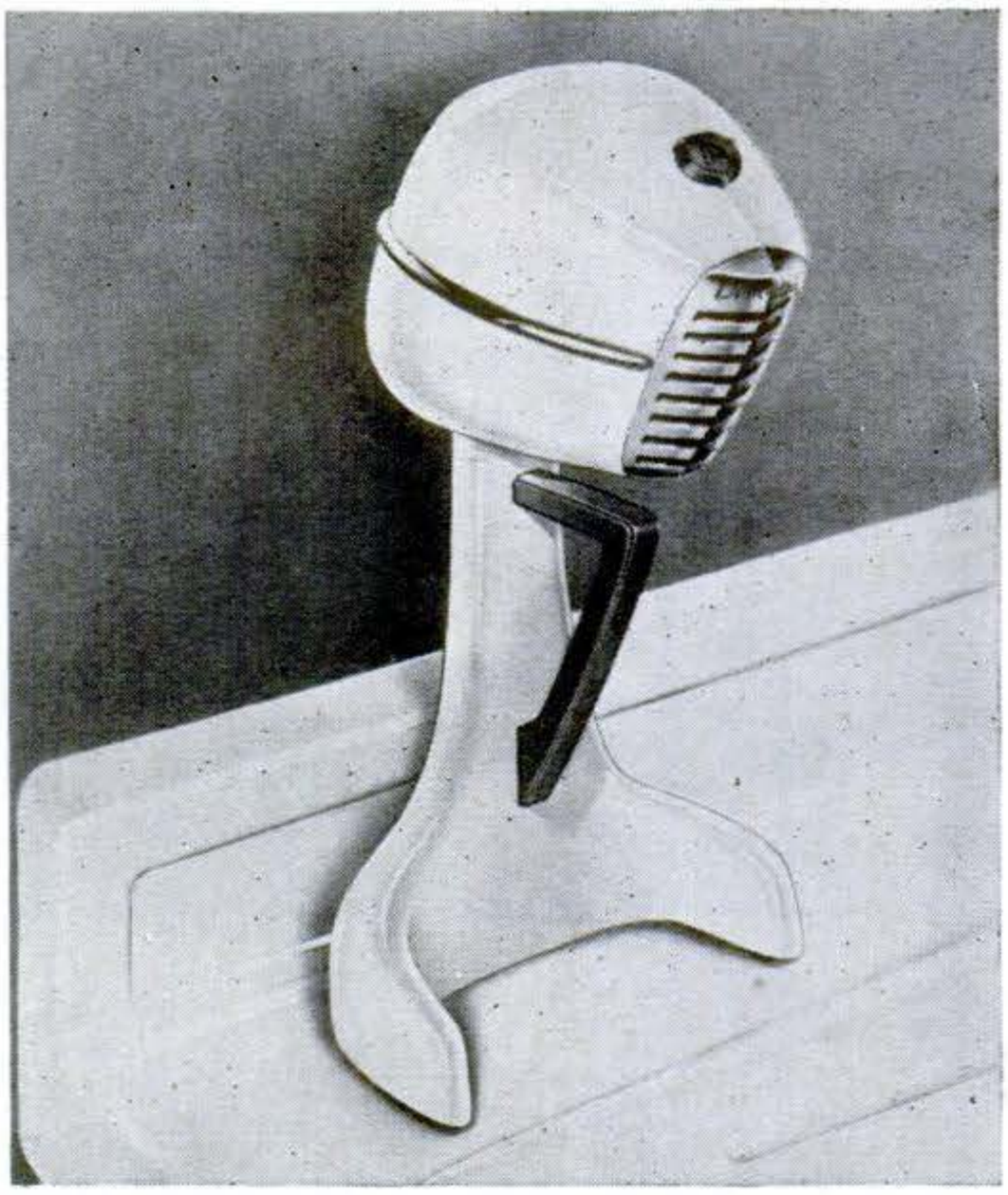
## Wall Bracket Holds Stockings

THIS lightweight, dirt-resistant Tenite® wall bracket provides snag-free drying space for five pairs of stockings. The stockings are hung up by slipping their toes through smooth-edged slits. The Row-O'Toes Mfg. Co., Portland, Ore., makes the brackets.



## Dish Drier Helps Husbands

HUSBANDS can throw away their aprons with this electric dish drier to help them out. The neat, compact unit, called Dish-Dri®, dries dishes easily and hygienically in a matter of minutes. Oscillating to insure full coverage, it sends a blast of hot air across dishes stacked in an ordinary rack. It can also be used for other chores such as thawing out frozen foods or drying light clothing. Made by the Electro-Mechanical Devices Co., Detroit, it retails for about $25.



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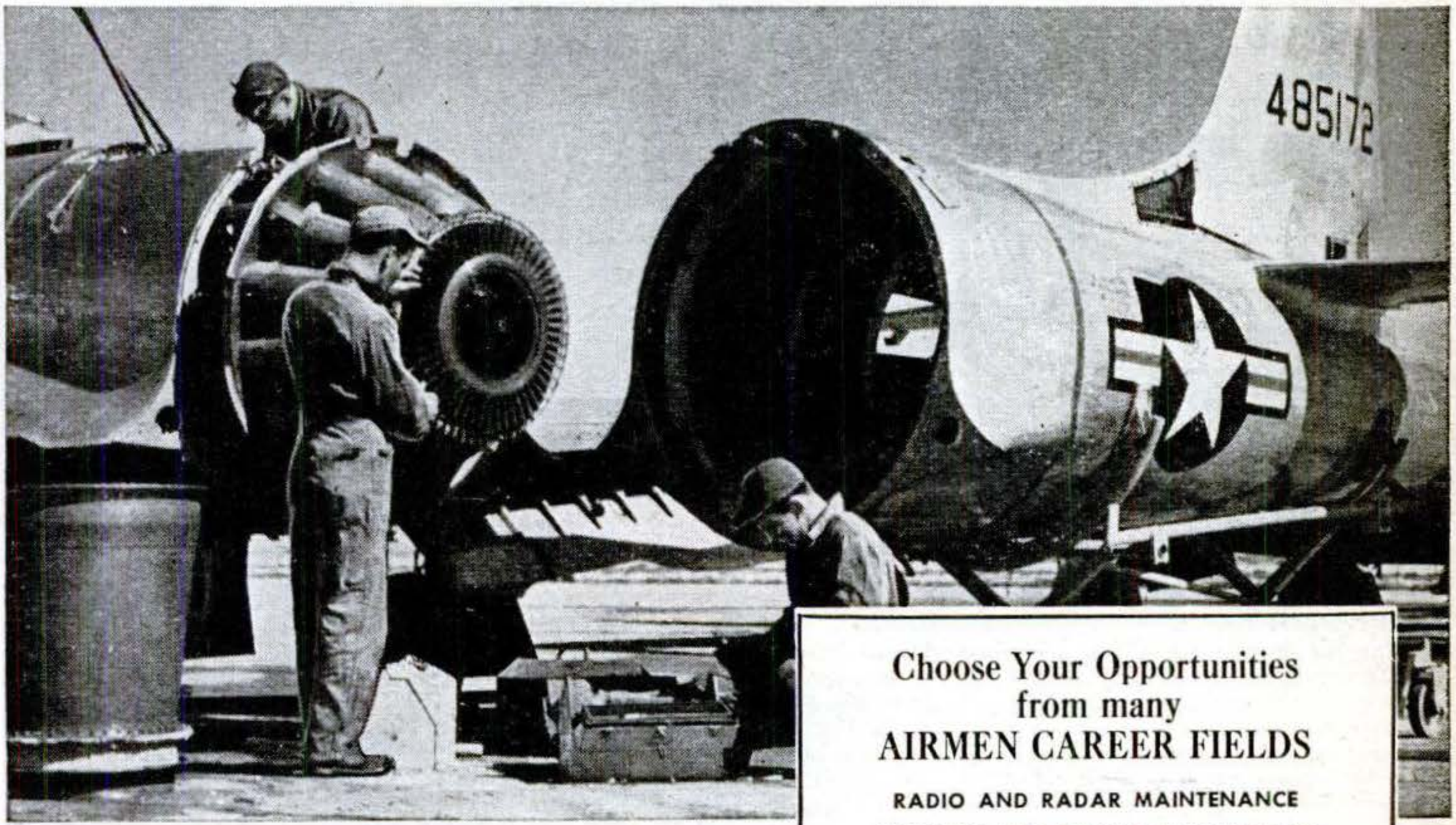


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Scientific aptitude tests help direct you to use your talents most effectively. Earn good pay right on the job as you learn under skilled experts. If you can qualify you may go to an Air Force technical school for training in one of the many great career fields. Enjoy new opportunities for education, experience, advancement. Ask about the new Airman Career Program today.

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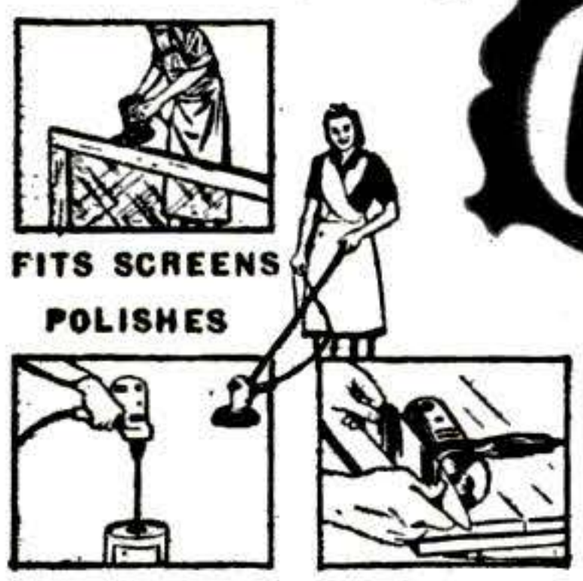
EASIER...
BETTER...
with this amazing

PORTER-CABLE Guild COMBO-TOOL

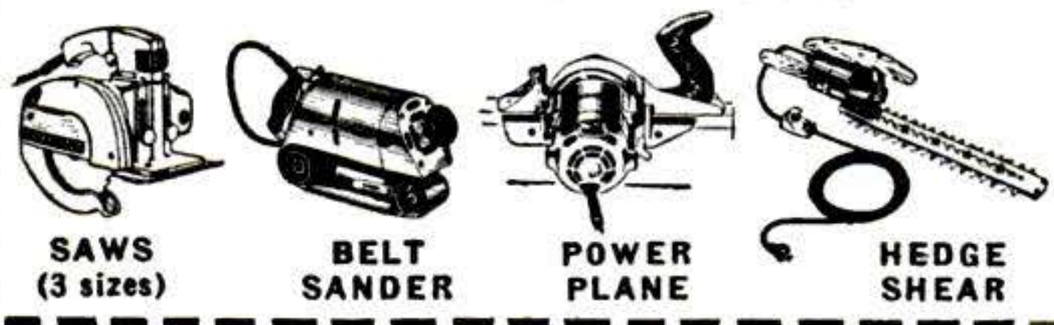



ONLY $44.50 for real quality

**Mr. Homeowner,** you can't find a more useful tool for spring-time jobs than this fine-performing Guild Combo-Tool. Simply by changing attachments on this light, *vibrationless* tool you have a "young workshop" at hand in a jiffy. You can sand, wire-brush rust, remove or mix paint. For refinishing work, it smooths surfaces beautifully — even to feather edging. You can buff and polish everything from the floor to the brass candlesticks. Rubs up furniture; sharpens cutlery; scours kitchenware. In fact, helps your wife many ways to remove the drudgery from spring cleaning chores.

And this power-packed tool is useful all year round — to speed up drilling, grinding, metal-cutting and many other irksome tasks. No gadget this — but a superbly balanced, precision-made tool that will give you years and years of service. Try one today at your hardware dealer's — may be purchased separately or in a versatile home-shop kit, complete with useful attachments.

**Other Guaranteed Guild Electric Tools**




Send me literature on Guild Combo-Tool and other Guild portable electric tools. Also name of nearest dealer.

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PORTER-CABLE MACHINE CO.
2304 N. Salina St., Syracuse 8, N. Y.

## Know the New Elements?

CHEMICAL elements 43, 61, 85, and 87 will henceforth be known, respectively, as technetium, promethium, astatine, and francium. Official adoption of these already widely used names at a recent International Union of Chemistry meeting in Amsterdam, Holland, finally settles a lively scientific controversy over rival claims to the elements' discovery.

The four elements were christened masurium, illinium, alabamine, and virginium by those who first reported discovering them, and these names appear in many existing tables. However, these claimed discoveries have been disputed, as based on doubtful and insufficient evidence. More recently, between 1937 and 1941, the four elements were again reported discovered and this time positively identified. The earlier claims are now officially ruled unacceptable and the newer ones upheld. Since the right to name an element belongs to its discoverer, the old names are superseded, and the ones proposed by the new finders are adopted—with one minor revision. The proposed new name prometheum has now been changed in spelling to promethium, to end in "ium" like those of most metallic elements.

Technetium (pronounced teck-NEE-she-um), the first element produced artificially, and astatine (pronounced AS-ta-teen), the only member of the halogen family without stable isotopes, take their names from Greek words meaning "artificial" and "unstable." Promethium is named for the mythical giver of fire to mortals, Prometheus. Francium honors France, the country where it was discovered.

Neptunium, plutonium, americium, and curium are names of other new elements officially approved at the Amsterdam meeting. These elements, increasing the total number known from 92 to 96, were discovered between 1940 and 1945. Neptunium and plutonium are named for the planets Neptune and Pluto, americium for the Americas, and curium for the famous discovers of radium, Pierre and Marie Curie.

In addition, the meeting revised the names of seven older elements, either by changes in spelling or by eliminating alternative names in former use. Lutetium and protactinium now replace lutecium and protoactinium. Beryllium and niobium will be used in preference to glucinium, an English



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**POLISHES** furniture, woodwork

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**ECONOMICAL!**

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**MINNEAPOLIS 2, MINNESOTA**

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*Only*
**$28.50 F.O.B.**

**DOES WELDING, BRAZING, SOLDERING, CUTTING**

This is one of the finest scientifically designed and precision-built genuine heavy duty transformer-welders on the market today! Made by an old established firm. High efficiency, heavy-duty output does work you'd expect from costlier machines. It's EASY TO OPERATE. Do expert work in a jiffy by following the simplified instructions furnished. Works on iron, steel, brass, bronze, aluminum or other metals. OPERATES from any convenient properly wired 110 VOLT A. C. line. SAVE TIME AND MONEY . . . build or repair your own auto, home, farm, or shop equipment and appliances, etc. Make big money doing work for others in spare or full time. OVER 50,000 SATISFIED USERS all over the country, hobbyists, maintenance and repair men, farmers, tinsmiths, engineers, home and auto owners. Order today on 10-day trial or send coupon for full details.

**GIFT WORTH $6.80 INCLUDED**

**For Prompt Action SEND ORDER TODAY**

**SEND TODAY FOR FREE DETAILS**

☐ Send Free details on Dynamic and Gift Offer.
☐ Send Dynamic and 10 day trial Enclosed $28.50 or $_____ deposit send C.O.D. for balance. Include Gift Offer.

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**DYNAMIC WELDER CO., Dept. D3-D44, 15 E. 23rd St., Chicago 16, Ill.**




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**POWER KING #3001**

**BALL BEARING TILT/ARBOR SAW**

Dollar for dollar, here's the greatest saw value on the market today! It's fast, accurate, easy to operate—ruggedly built—with features usually found only on saws costing much more!

Handles big range of work—cabinets, cupboards, bookcases, shelves, home repairs, model building—makes fine woodworking easy and more fun. Quickly pays for itself in the money you save.

*Tilt/arbor design* keeps work and table flat. Blade cuts 2¼" deep. Table is 25½" x 16" with two low-cost extensions. *Sheet steel base—precision ground grey iron* table. *Quick-positioning rip fence* and *sealed ball bearings.*

See the great PK 3001 at your Power King dealers soon, or send today for free catalog.

NEW FREE CATALOG

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Address_____

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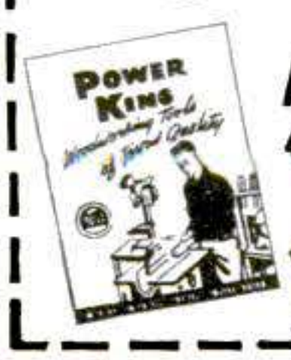


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442 N. Pitcher St., Kalamazoo, Mich.

MATCHED PRECISION TOOLS FOR WOODWORKING AND METALWORKING


name for the first, and columbium, an American name for the second. "Wolfram" will be the future name for tungsten in technical literature, although like the scientific name of "aluminium" for aluminum it may fall short of wide popular acceptance.

To bring existing lists of names and symbols of the elements up to date, they should be corrected to agree with the new official listings. Transmitted directly to POPULAR SCIENCE by Prof. Alexander Silverman of the University of Pittsburgh, United States representative at the international meeting, these are given below:

| *Atomic Number* | *Element* | *Symbol* |
|---|---|---|
| 4 | Beryllium | Be |
| 13 | Aluminium | Al |
| 41 | Niobium | Nb |
| 43 | Technetium | Tc |
| 61 | Promethium | Pm |
| 71 | Lutetium | Lu |
| 72 | Hafnium | Hf |
| 74 | Wolfram | W |
| 85 | Astatine | At |
| 87 | Francium | Fr |
| 91 | Protactinium | Pa |
| 93 | Neptunium | Np |
| 94 | Plutonium | Pu |
| 95 | Americium | Am |
| 96 | Curium | Cm |

## FCC Names Frequency Bands

TO STANDARDIZE references to various parts of the radio spectrum, the Federal Communications Commission has officially adopted the frequency-band abbreviations listed below. This system applies to all non-government radio services in the U. S.

VLF (very low frequency)—
below 30 kilocycles

LF (low frequency)—
30 to 300 kc.

MF (medium frequency)—
300 to 3,000 kc.

HF (high frequency)—
3,000 to 30,000 kc.

VHF (very high frequency)—
30 to 300 megacycles

UHF (ultra high frequency)—
300 to 3,000 mc.

SHF (super high frequency)—
3,000 to 30,000 mc.

EHF (extremely high frequency)—
30,000 to 300,000 mc.



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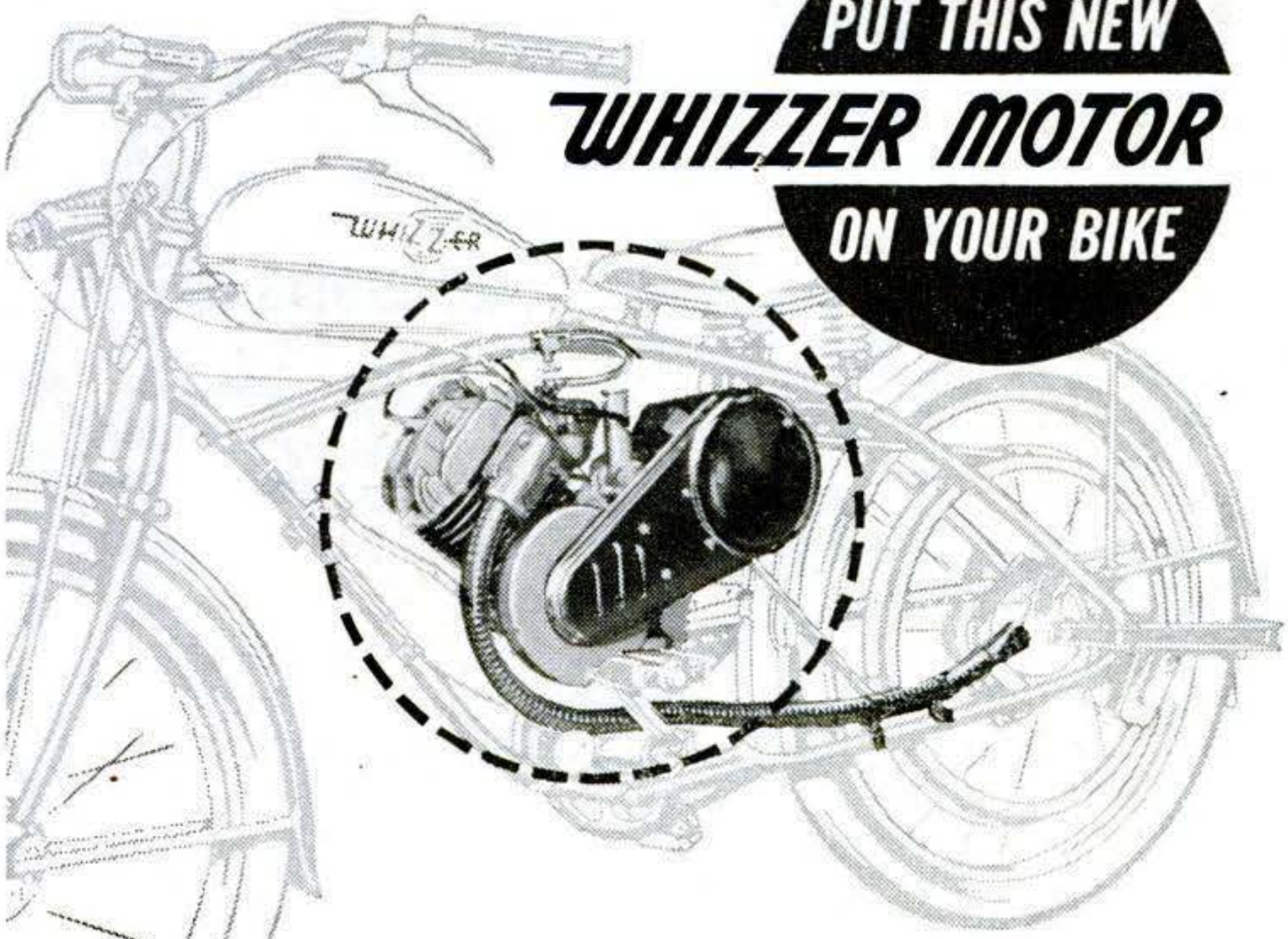


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**40 Miles an Hour**

**Up to 100 Miles per Gallon**

Motorize your bike with America's famous Whizzer motor, and get the thrill of real riding pleasure—no more pedalling! Packed with power, precision-built, air-cooled. It's thrifty, it's rugged, it's America's finest bike motor. Fits any adult-sized bike.

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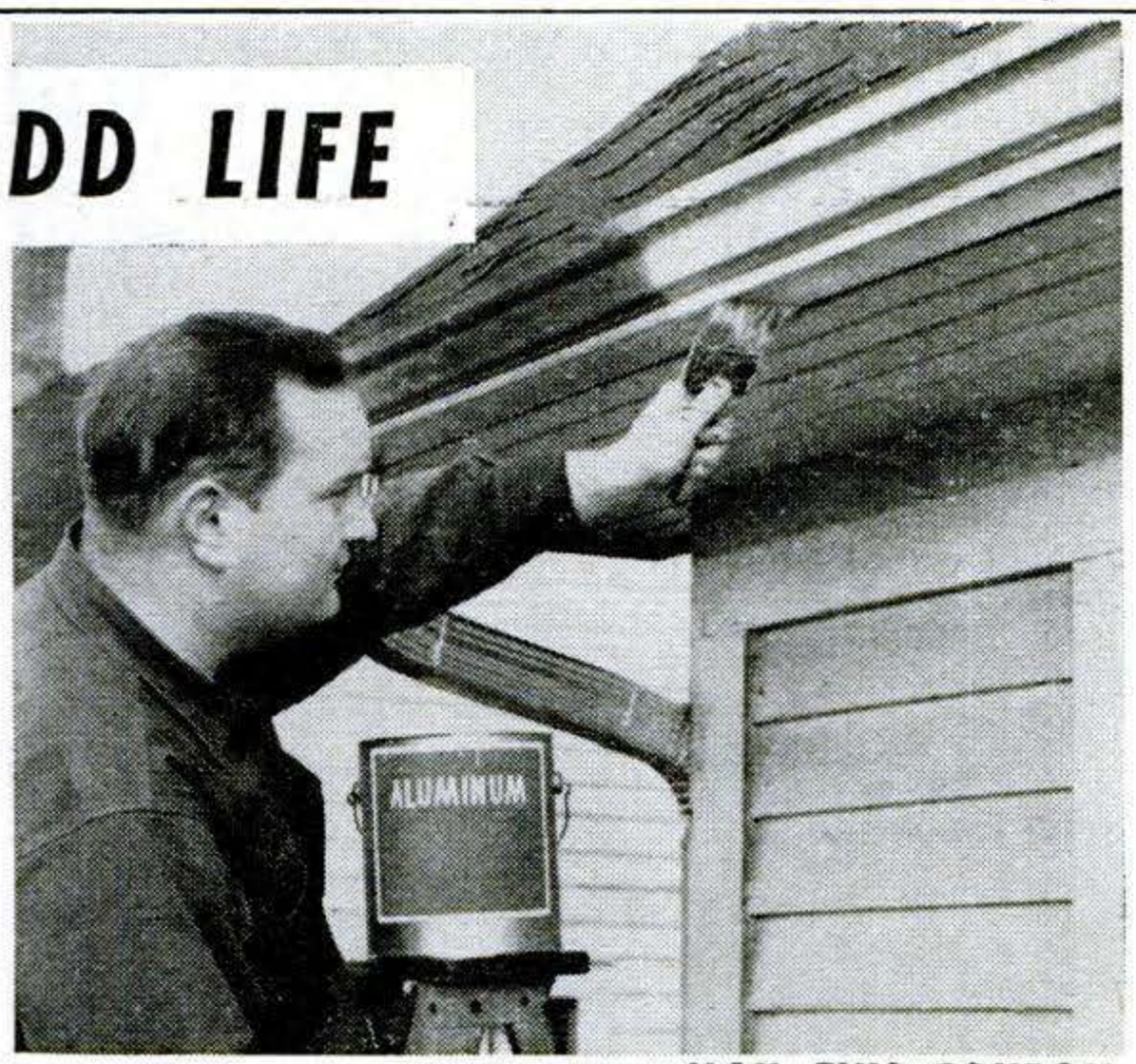
Ride One and You'll Buy One!

***ALSO SEE THE WHIZZER "SPORTSMAN" • A NEW MOTORBIKE!***

Whizzer's new star of the lightweights! Powered by Whizzer's 3 h.p. motor! A complete motorbike with 2-speed transmission, automatic shift, kick starter, auto-type brakes, many other features! See, ride, buy the great, new Whizzer Sportsman. $239.50 plus tax F. O. B. Pontiac. Ask your dealer *today* about liberal trade-in, easy payments.

**WHIZZER MOTOR COMPANY, 314 S. SANFORD, PONTIAC 20, MICHIGAN**

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Here's an inexpensive way to add years of life to downspouts and gutters—keep them bright and attractive.

FREE BOOK TELLS HOW—Send for free copy of "Paint It Bright"—the 24-page book full of helpful painting hints. And remember, there *is* a difference in aluminum paints. Downspouts and gutters, for example, call for Aluminum Metal & Masonry Paint. It's available from the dealer who displays the Alcoa Symbol of quality on the brand he sells.

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***MAIL THIS COUPON***

**Paint Service Bureau, ALUMINUM COMPANY OF AMERICA, 1717D Gulf Building, Pittsburgh 19, Pa.**

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Address or RFD No. _____

City _____ State _____

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Look for this shield on aluminum paints *made by many paint manufacturers using* **ALCOA PIGMENTS**




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## *Add* BARDAHL *to Your Crankcase Oil*

WHEN your engine hollers, give it help—RIGHT AWAY! Simply add one quart of BARDAHL to regular oil.

Instantly BARDAHL goes to work at the point of friction. Forms tough protective film on moving parts to halt further wear. Relieves dangerous heat that may cause breakdown.

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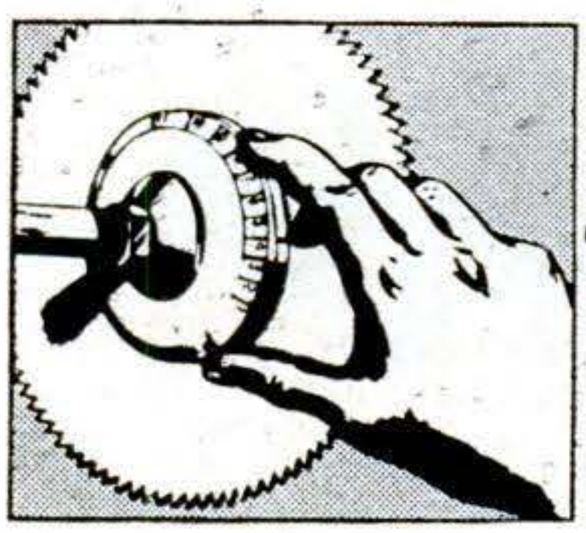
## with *Warren* DADO SAWING WASHERS



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Cut accurate, parallel grooves—any width, any angle. Just dial desired width with Micromatic adjustment. Cuts smooth and clean—no burning or chewing to mar fine wood. Just four simple washers. Available in 5 sizes—½", ¾", ⅝", 1", 1⅛". Free booklet on request. See your dealer or write direct. Absolutely guaranteed! In Canada, send money order for $4.95 (duty and sales tax extra).

**$4.95 A SET**

**Dealers, Jobbers, Write for Information!**

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**70 Medbury, Dept. 44, Detroit 2, Michigan**

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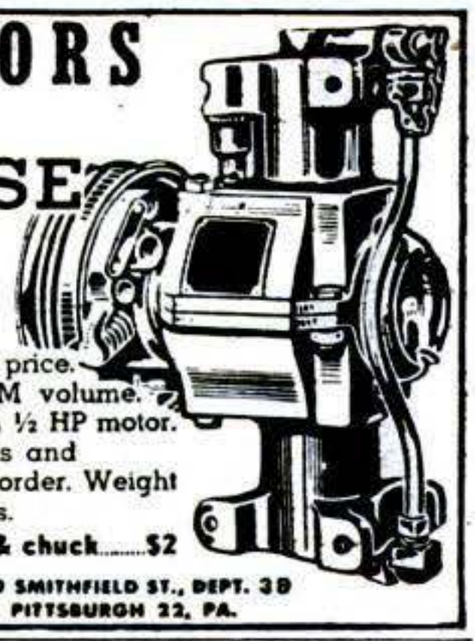
**Lowest-Ever Closeout Price!**

## WESTINGHOUSE

Reg. $60.50 **18.50** FOB PGH.
**Model T-1 Complete**



Brand New Surplus Special at an amazing low price. Westinghouse Double-piston type, 6.54 CFM volume. Mounts on truck or car engine—or operate with ½ HP motor. For farm, home, industry, painters. Instructions and spare parts kit included. Send check or money order. Weight 26 lbs. We carry a complete line of spare parts.

**AIR HOSE—to fit, 25-ft. length with fittings & chuck.....$2**

**NATIONAL STORES** 200 SMITHFIELD ST., DEPT. 3B PITTSBURGH 22, PA.

# Sprunger *precision built*

8" Tilt Arbor Saws BL$74.95; "C" $49.95

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pay for themselves on just a few jobs. Make your own furniture, home repairs, etc. with these rugged, precision tools.

*See them at your dealers.*

14" Band Saw $84.95

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**WRITE Dept. PS-45** for latest literature. (Prices subject to change without notice.)

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***Save time . . . Save work . . . Save money***

• Right-angle drive with oversize guards is super-safe, perfectly balanced for one-hand use. Attach it to any drill ¼" and up, in seconds. Full 1⅛" cut, handles 2" stock by turning over. Machined cutting guide for extra accuracy. Oilite bearings, sealed gears for long life. Complete with 4" high speed steel saw blade. Money-back guarantee.....*only* **$7.95**

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**GLEAM PRODUCTS (Dept. X-4) Whitestone, L. I., N. Y.**



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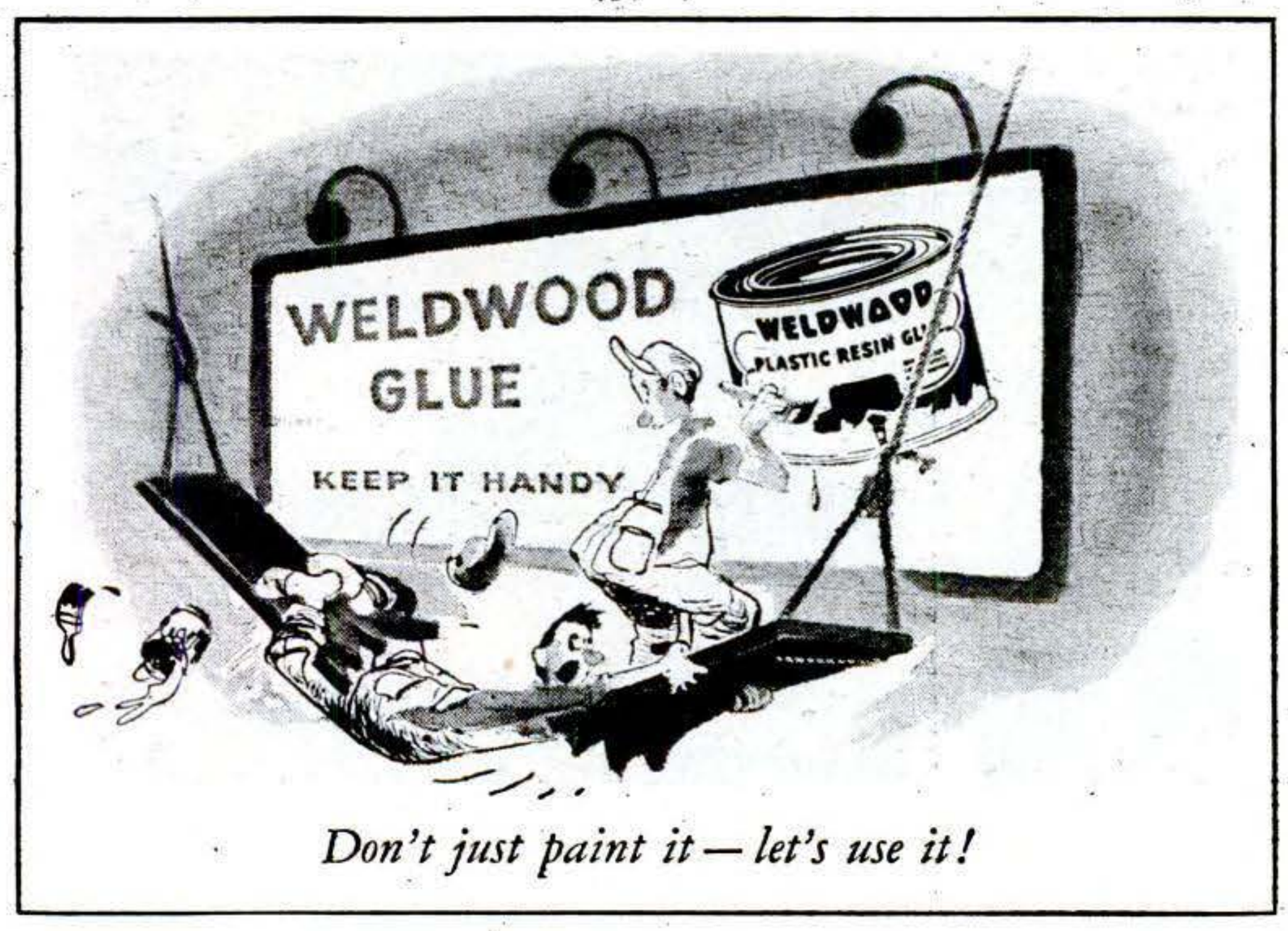


*Don't just paint it — let's use it!*

Remember Weldwood Glue when you need dependable wood-to-wood bonds. Quick and easy to mix with cold water... tremendously strong... stain-free... rot-proof ... and *permanent*. At paint, hardware, variety stores and lumber yards. 15¢, 35¢, 65¢, 95¢ and larger sizes.

**WELDWOOD** PLASTIC RESIN GLUE

*United States Plywood Corporation, New York 18, N. Y.*

## ALSO HANDY FOR WOOD HOBBYISTS!

**Firzite**

*—to give you smooth finishes on fir plywood and other soft woods.*

A pre-finishing material that seals the wood pores...tames the wild grain . . . virtually eliminates checking and grain raising. An excellent base for stain, paint or enamel. White or clear. White Firzite provides an easy, low-cost way to achieve "blond," "bleached" or "wiped" finishes.

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*—to preserve the beauty of all woods.*

An inexpensive coating for the proper finishing of Weldwood Hardwood Plywood and similar woods. Clear. No brush marks. Brings out all the natural beauty of wood. Does not yellow or darken with age.

*FIRZITE and SATINLAC are available from paint, hardware and lumber dealers. Write for leaflet No. 4 on finishing plywood.*

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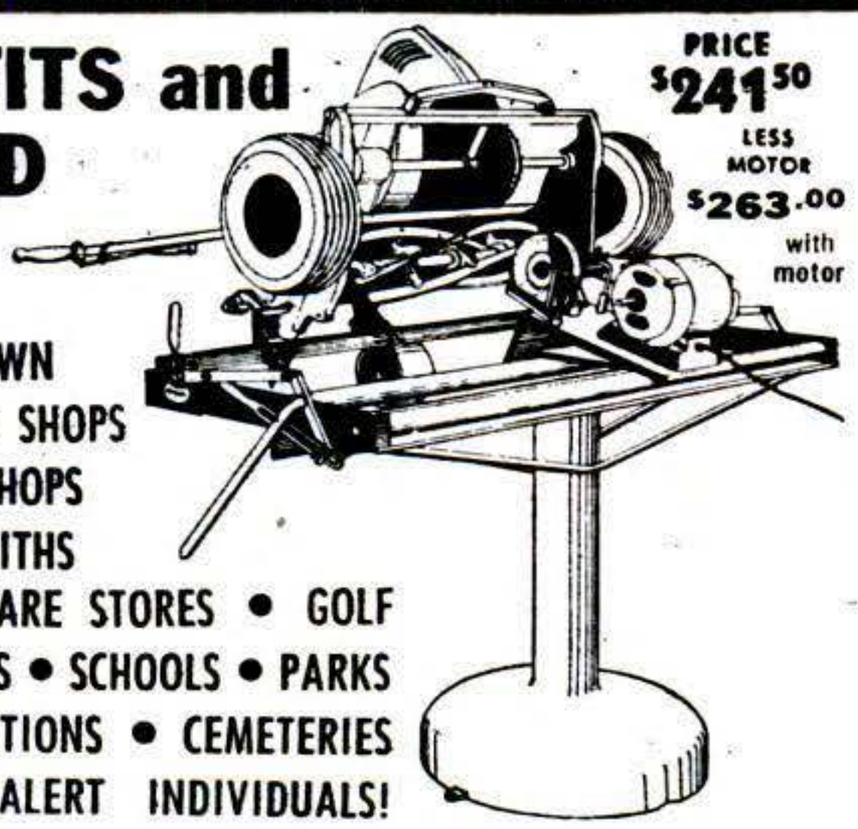
**PROFITS and SPEED**



PRICE $241.50 LESS MOTOR $263.00 with motor

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*Sharpens All Reel Type Mowers • Hand, Power or Gang • 10 to 20 Minutes • No Dismantling No Extra Attachments Needed*

All reel type mowers, from 5-inch edgers to 36-inch power mowers, are quickly sharpened to extreme ends of both left and right twist reel blades. Handle, wheels, roller and motor remain in place when sharpening is in process. Bed knife is sharpened in same brackets that hold mower in grinding position. No extra attachments required. One lever puts mower or bed knife in grinding position. 100% steel construction. Grinding head rides on five ball bearing races. Easy to operate. Sharpens wood chisels, joiner knives and planer blades without extra attachments.

**ORDER NOW** Immediate Delivery

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**Send for FREE ILLUSTRATED BULLETIN No. 11C**

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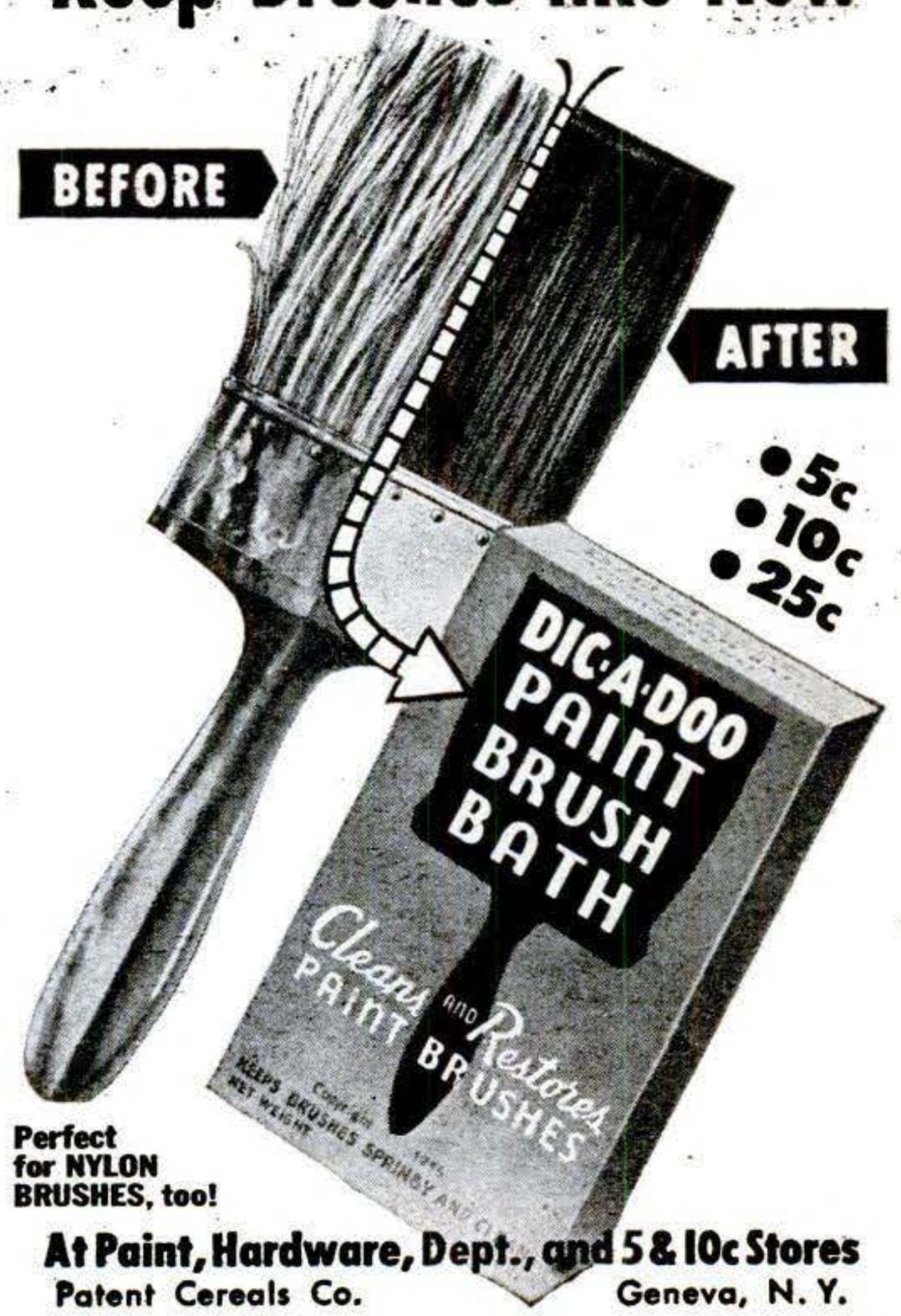


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**At Paint, Hardware, Dept., and 5 & 10c Stores**

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# FOLEY SAW FILER

Here is a steady repeat CASH business you can start at home in your basement or garage, while you are working at your regular job. No experience is necessary to turn out perfect cutting saws —"the first saw I sharpened came out 100%. I think the Foley Saw Filer is a marvel of perfection," writes Clarence E. Parsons. Every saw you sharpen will bring you new customers. You will find you can make up to $2 or $3 an hour—$20 to $30 a week in your spare time as a starter.

With a Foley Saw Filer you can file all hand saws, also band and cross-cut circular saws. It is easy to operate—simple adjustments—no eyestrain. Patented jointing principle evens up all irregular teeth and makes an old saw cut just like new.

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**"INDEPENDENCE AFTER 40!"**

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Send me free book **"INDEPENDENCE AFTER 40!"**

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**Triple Duty**

1. Trims lawns velvety smooth.
2. Cuts tall weeds and grass.
3. Pulverizes leaves—abolishes raking, hauling and burning.

It's great fun to trim the lawn with the New Mow-Master. It is lighter than ever, handles like a dream and mows everything. All metal rugged construction, built for the toughest mowing jobs. Amazing New Grind-a-Leaf attachment pulverizes leaves. Surplus of smooth flowing power from improved 2 H.P. POWER-PAK Engine. See it at your dealers.

**FREE** booklet "POINTERS ON MAKING GOOD LAWNS" and our MOW-MASTER Literature sent upon request.

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## *Build your own* SMITH Compressor

**Operates spray guns, rock drills, tampers, paving breakers, sandblasting . . . Uses only 1 gallon of gas an hour!**

Save Money—build your own Smith Air Compressor! Famous the world over! Capacity 60 cu. ft.; pressure up to 100 lbs. per sq. inch. Just order the Smith Compressor Head and Accessories with complete instructions for assembling. All you need is a Ford Motor and shop facilities. Head equipped with high speed compressor valves; automatic unloading and idling.

*Write for complete information!*

GORDON SMITH & COMPANY, Inc.
405 College Street • Bowling Green, Ky.

# HOLD-E-ZEE

The Original *AUTOMATIC GRIP SCREWDRIVERS*

Hold, start and set up screws in unhandy places. Gripper instantly released by SPRING ACTION, sliding up out of way when not in use. Highest quality throughout.

*New Models* FOR RECESSED HEAD SCREWS ➧ ⊕ ⊕

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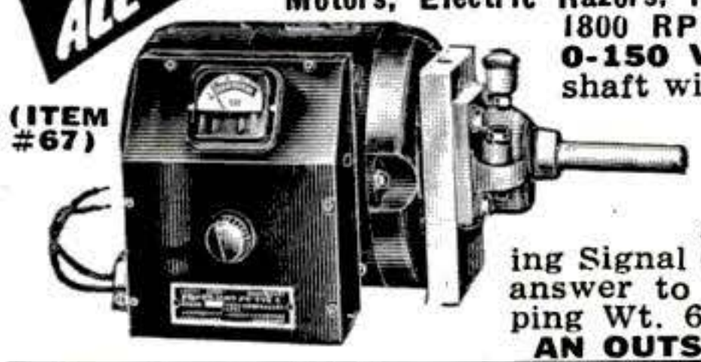
ALL BRAND NEW - UNCONDITIONALLY GUARANTEED!

## 115 VOLTS 60 CYCLE A.C. LIGHT PLANT GENERATOR

IDEAL FOR: Home Lighting, Hunting Lodges, Stand-by Electricity, Running All AC Electrical Appliances including: Fans, Motors, Electric Razors, Refrigerators, Incubators, etc. 750 Watts at 1800 RPM using 1½ HP gasoline engine.



(ITEM #67)

**0-150 Voltmeter** with Regulator; 1" diameter shaft with keyway for direct or belt drive, carried in two bearings, one bronze and one ball-thrust bearing. Protection for emergencies to operate oil burner, stoker, freezer, water pump, and lights. These units, built to exacting Signal Corps specifications, are the answer to your lighting needs. Shipping Wt. 60 lbs. . . . . **59.50**

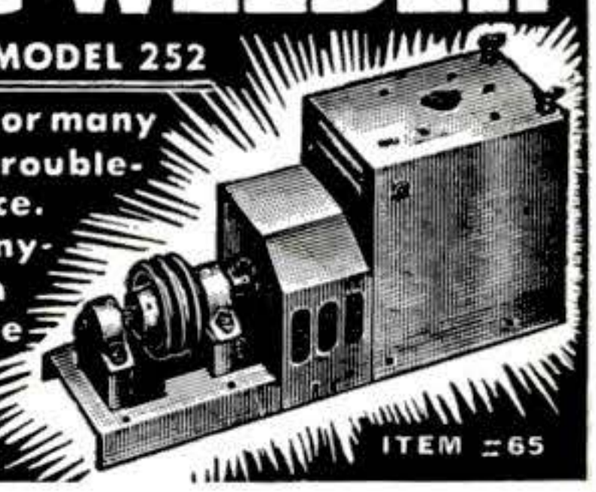
**AN OUTSTANDING VALUE** F.O.B. Chicago

NOW . . . It's Easy to Weld with this handy

## ARC WELDER

250 AMP. MODEL 252

Designed for many years of trouble-free service. Handles anything from light gauge sheet metal to ½" plate



ITEM #65

### FOR ANY WELDING JOB, LIGHT OR HEAVY

This precision-engineered direct current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly, where and when you need it.

The War Surplus generators for these Arc Welders were built by General Electric, Westinghouse, and Delco-Remy at a cost of over $300.00. They are light in weight; have oversized lifetime grease-sealed ball bearings; air-cooled commutator; dial type rheostat for easy pinpoint control; high-low range switch; reactor coil for even arc; handles 1/16" to ¼" rods. Run welder at 2500 R.P.M. from drive pulley or power take-off of tractor, a 7½ H.P. electric motor or a 10 H.P. gas engine. Use two V-belts, or flat belt (on pulley). Continuous welding rating—200 amps.; intermittent rating —250 amps.; 0-30 volts. Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Ship. wt. 107 lbs. Only one or two jobs will pay for entire welder. F.O.B. Chicago **99.50**

**ACCESSORY KIT** including welding helmet, electrode holder, two 10 ft. cables with clamp, and 5 lbs. of assorted welding rods. (ITEM #66) F.O.B. Chicago **10.50**

**Remember, Satisfaction is Guaranteed**

*Gear Type—All Manganese Bronze*

## INSECTICIDE PUMP

**FOR SPRAYING D.D.T., 2,4-D, SULPHUR COMPOUNDS, ETC.**

(Item #50)

Pressures up to 200 lbs. and 14 gallons per minute—at 1200 R.P.M. Will not rust, pit, foul or freeze up. Use rubber hose inlet. ¾" pipe outlet. Equipped with double mounting bracket. Weight 24 lbs. Dimen. 8"x7"x10". Standard 1" manganese bronze shaft with keyway. **U. S. Govt. Acquisition Cost $62.00. NOW** . . . . . **15.00**

**FREE—complete instructions and performance data with each pump.** F.O.B. Chicago

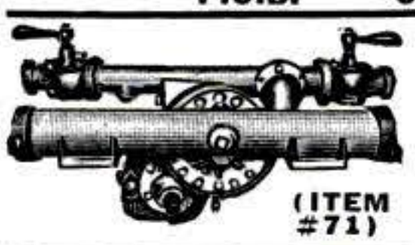
## PNEUMATIC AIR DRILLS

*Used—Like New*

Light, powerful, compact, pistol grip, trigger control. Ideal for shop use where air pressure is available.

**ITEM # 80** — Ingersoll-Rand. Equipped with ¼" Jacobs key chuck. Overall dimen.: 6½" long, 5" high, 1½" thick. Wt. 3 lbs. F.O.B. Chicago . . . . . **14.95**

**ITEM #81**—Chicago Pneumatic, Larger Size, Model A, equipped with ¼" Jacobs key chuck. Overall dimen.: 7½" long, 5" high, 2" thick. Wt. 4 lbs. F.O.B. Chicago . . . . . **19.95**



(ITEM #71)

## WATEROUS PUMP

Rated 500 gallons per minute at 120 P. S. I. This high efficiency pump is designed for front end mounting on General Motors, Dodge, Studebaker and Ford trucks and comes complete with gear box and power take-off for easy mounting and attachment to crank shaft. Net weight of pump 500 lbs. Shipping weight 1200 lbs. F.O.B. Chicago **149.50**

## FREE: 1950, 44-PAGE CATALOG

Chuck-full of sensational War Surplus "buys" and informative data on hydraulic applications. Write for yours today!

NEW AIRCRAFT QUALITY

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**Large supply of new labor-saving, economical hydraulic equipment in many types and sizes . . . including actuating cylinders, control valves, tanks, pumps, fittings, hose, and data on hydraulic applications. Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, brakes, plastic dies, auto frame alignment, etc., etc.**

**ITEM # 70**—Purolator hydraulic oil filter **Postpaid** . . . . . **4.95**

**ITEM #33C**—Double action hydraulic cylinder. 1½" bore. 4½" stroke. Clevis mountings at both ends. Uses ¼" pipe fittings. **Postpaid** . . . . . **8.95**

**ITEM #16**—Double acting cylinder. 1½" bore. 27" stroke. (Will lift 1760 lbs. in 2 seconds with Logan Pump.) Wt. 8 lbs. A $55.00 hydraulic cylinder value for only **postpaid** . . . . . **12.95**

**ITEM #17**—Double acting cylinder, 2⅜" bore. 8" stroke. (Will lift 4400 lbs. in one second with Logan Pump.) Will withstand 1500 P.S.I. against wall. Wt. 7 lbs. A $65.00 value . . . . . **postpaid** **14.50**

**ITEM #15**—Double acting cylinder. 3" bore. 8½" stroke. All steel hydraulic cylinder. (will lift up to 7000 lbs. in 3 seconds with Logan Pump.) Wt. 12 lbs. A $78.00 value . . . . . **postpaid** **19.50**

(ITEM #42)

**ITEM #31**—Double acting cylinder, 3½" bore, 11" stroke. (Will lift 9600 lbs. in 7 seconds using Logan Pump.) Wt. 15 lbs. A $92.00 value . . **postpaid** **22.50**

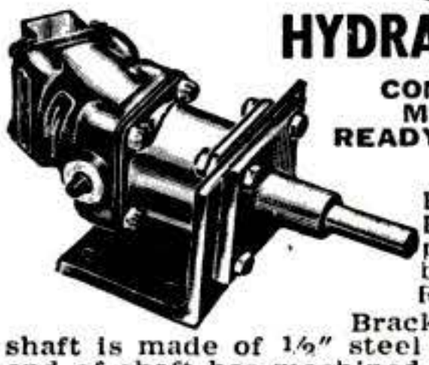
**ITEM #42**—Double action hydraulic cylinder. 4" bore. 18" stroke. Rated lift capacity with 1000 P.S.I. input is 12,560 lbs. using Logan Pump. Ship. wt. 30 lbs. AN EXCELLENT VALUE for . . . . . **F.O.B. Chicago** **32.50**

**ITEM #61**—Double acting Hanna air cylinder, 5" bore, 26½" stroke. 40½" overall length closed. With 100 lbs. input will lift 1900 lbs. Net wt. 89½ lbs. Gov't. acq. cost $101.85 . . . . . **F.O.B. Chicago** **39.50**

**HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for ⅜" pipe and 50c ea. for ½" pipe.**

VICKERS MF9

## HYDRAULIC PUMP or MOTOR



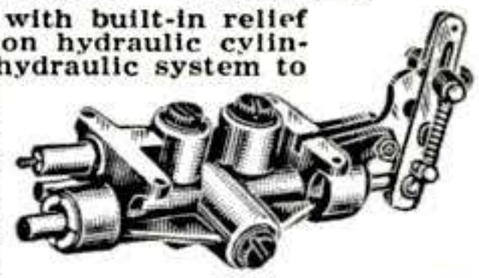
**COMPLETE WITH MOUNTING KIT READY TO INSTALL** **19.90** POSTPAID $75.00 value

Pump is compact, powerful, rated 1,000 P.S.I., .507 cu. in per revolution. 8 gal. per min. at 3750 RPM. Change rotation by reversing flow. Delivers up to 6 H.P. Requires ⅓ to 6 H.P. to drive.

Brackets are constructed of heavy steel plate: shaft is made of ½" steel with one end splined to fit pump: other end of shaft has machined flat for mounting a standard pulley with ½" hole. Shaft runs in oilite bronze bearings.

**PUMP ONLY (ITEM # 18)** . . . . . $14.95 postpaid
**MOUNTING KIT ONLY (ITEM #38)** . . . . . $ 4.95 postpaid
**BOTH AS COMPLETE UNIT (ITEM #39)** . . . . . $19.90 postpaid

## HYDRAULIC CONTROL VALVES



**ITEM #24**—Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Ship. wt. 8 lbs. A $38 **Value. Postpaid** . . . . . **7.95**

**ITEM #26**—Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A $60 value **postpaid** . . . . . **10.95**

**ITEM #28**—A two cylinder double action valve with a unique arrangement, allowing the operator to raise both cylinders simultaneously, to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Ship. wt. 8 lbs. A $75.00 value. **postpaid** . . . . . **14.95**

## LOGAN HEAVY DUTY HYDRAULIC PUMP

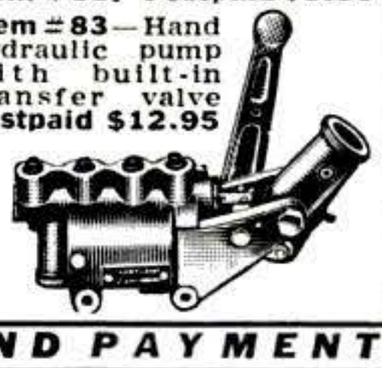
(ITEM #29)

. . . for operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 8 GPM at 1200 RPM at 1000 P.S.I. using 5 H.P. Has ½" pipe thread inlet. ⅜" pipe thread outlet. ¾" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5½" H x 5½" W. A $105.00 value. FOR ONLY . . . . . **22.50** F.O.B. Chicago

## HAND HYDRAULIC PUMP

**Item #11.** Postpaid **$8.95**

**Item #83**—Hand hydraulic pump with built-in transfer valve **Postpaid $12.95**



LOGAN HEAVY DUTY

## HYDRAULIC CONTROL VALVE

Has built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or two cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removable mounting brackets with 4 bolt holes, ⅜" pipe thread connections. Overall dimen.: 12½" H x 8½" D x 8" W. Ship wt. 17 lbs. Govt. Acquisition cost over $100.00. An Excellent Buy. F.O.B. Chicago . . . . . **21.95**

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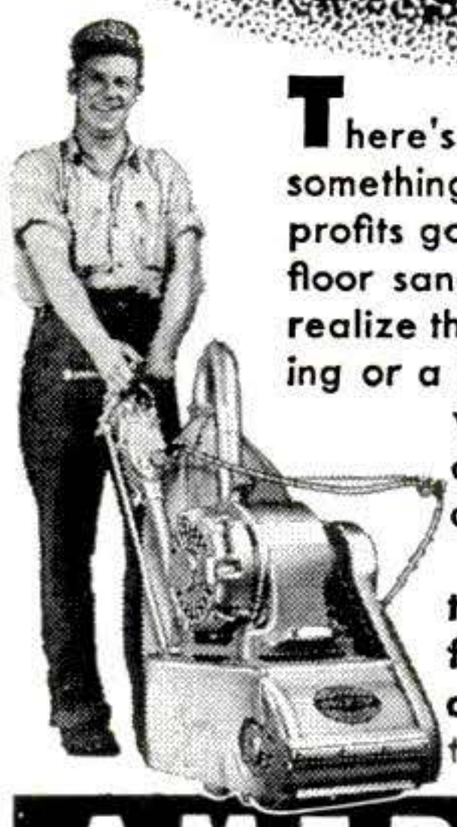

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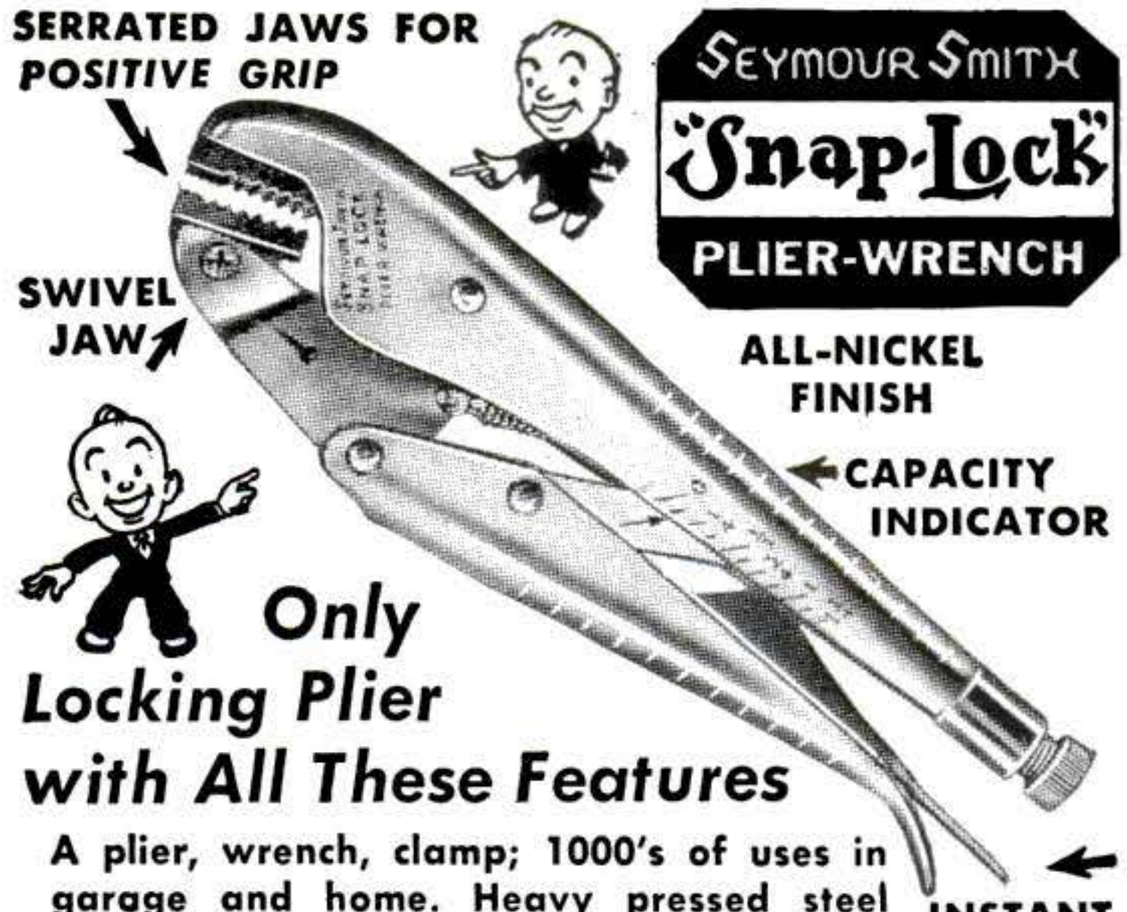


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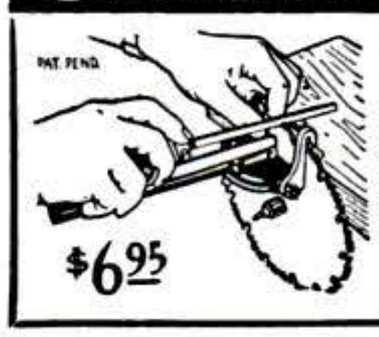


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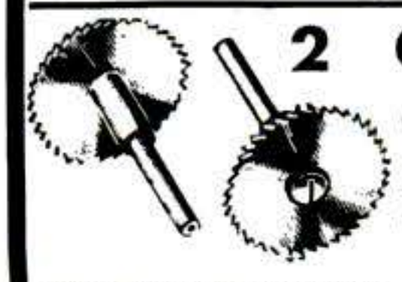

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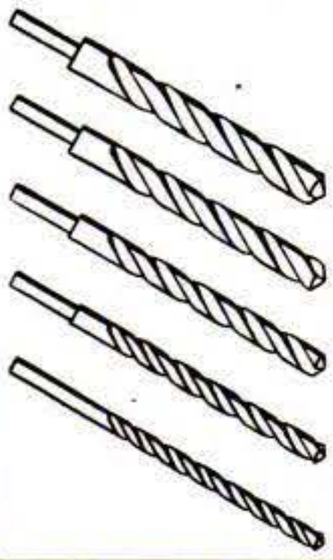
## FOR YOUR 1/4" ELECTRIC DRILLS



Make your drills do double duty. We have available for you, for the first time, steel drill bits up to 1/2" for use in your 1/4" chuck. Made by one of the world's largest manufacturers of cutting tools, this new set consists of one each 1/4", 5/16", 3/8", 7/16" and 1/2" bits. Priced at only **$3.95**

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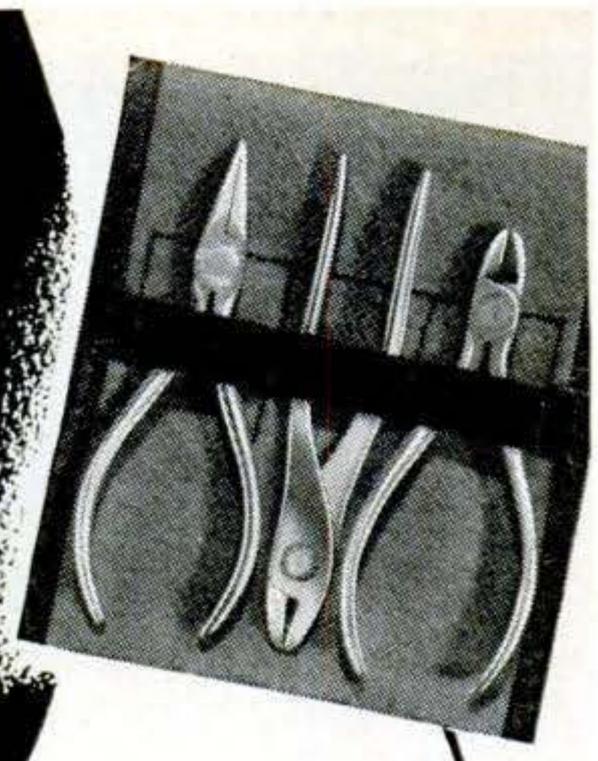

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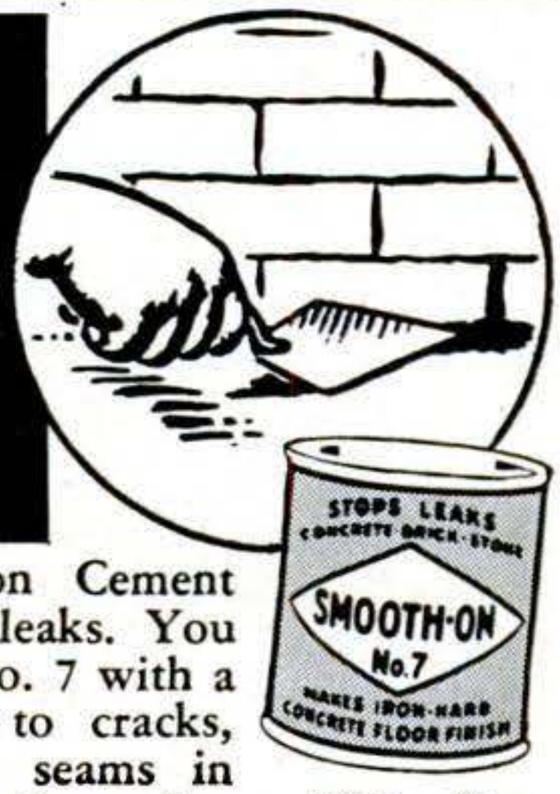


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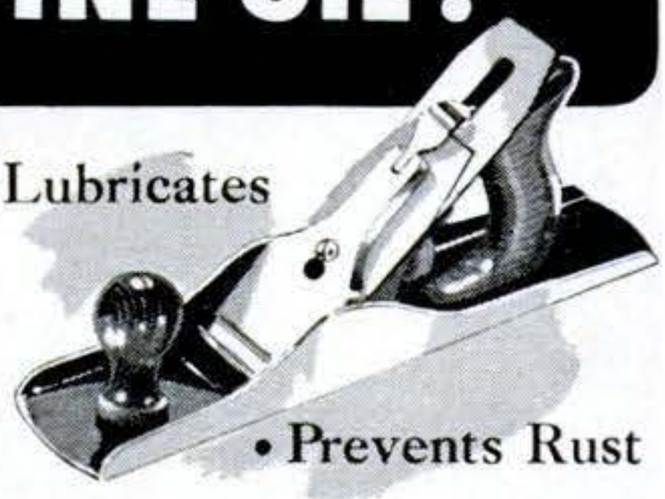

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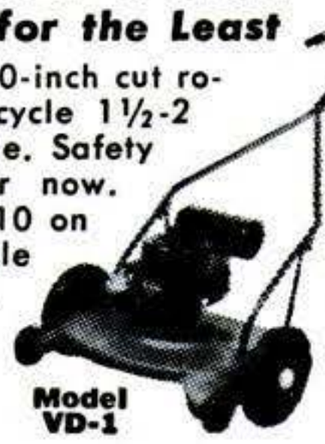

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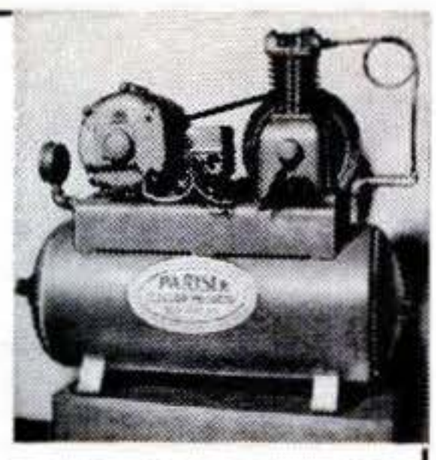

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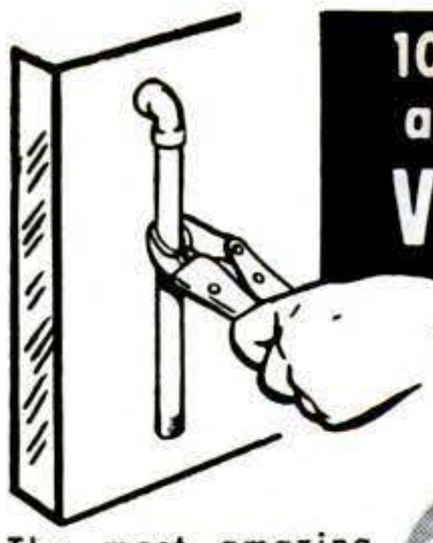

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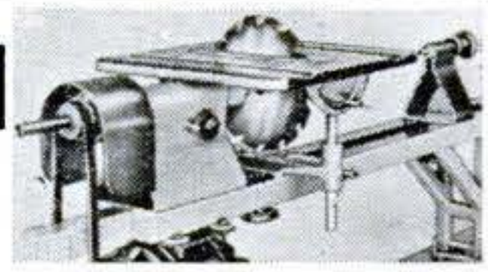

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| Bore | O.D. | Type | Price |
|---|---|---|---|
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| 3/16" | ½" | Needle | 15c |
| ¼" | ⅝" | Needle | 15c |
| ¼" | ¾" | Ball | 22c |
| 5/16" | ½" | Needle | 15c |
| ⅜" | ⅞" | Ball | 35c |
| ½" | 1¼" | Ball | 40c |
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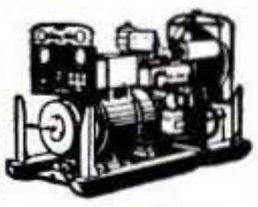

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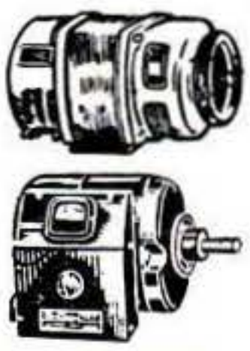

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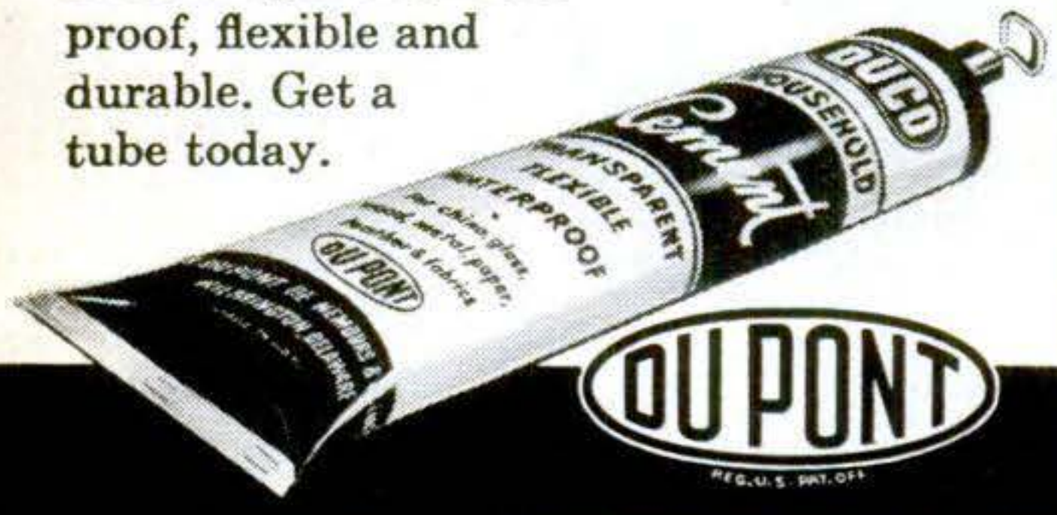


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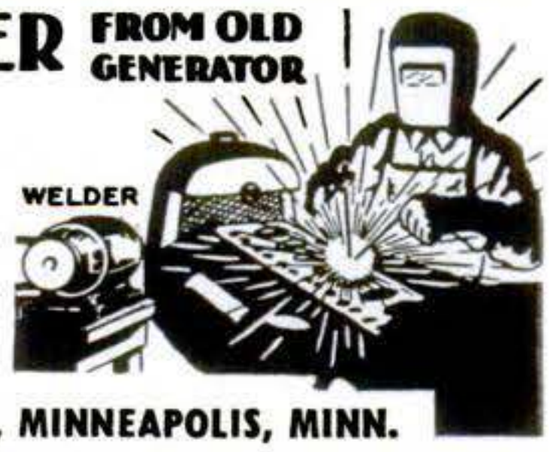


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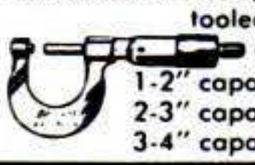

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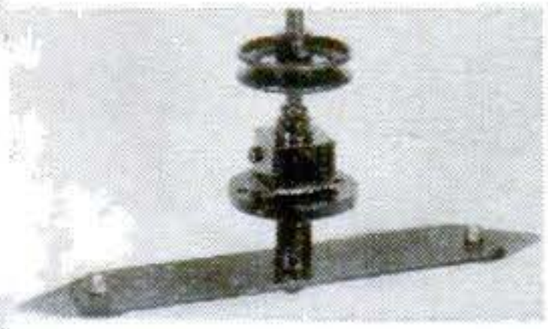

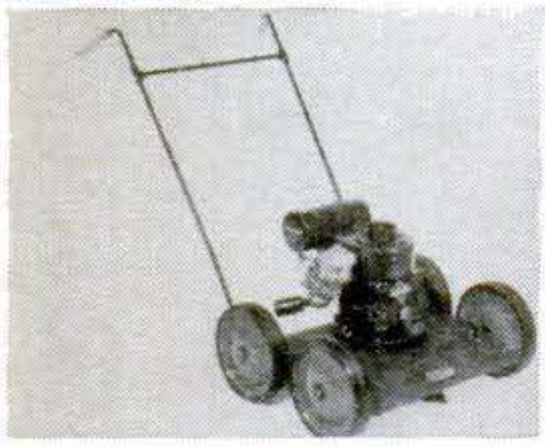

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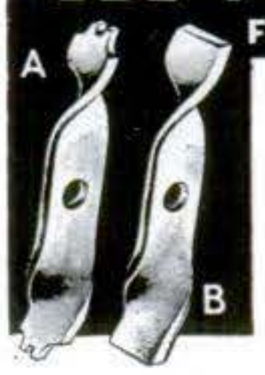


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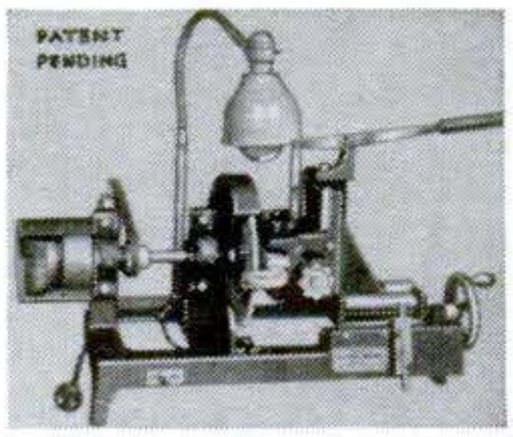


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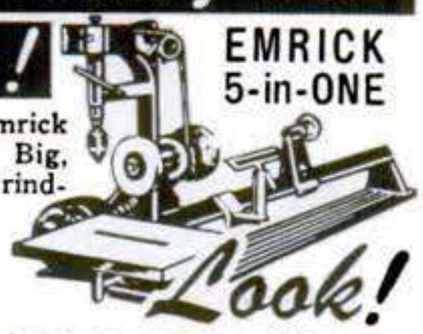


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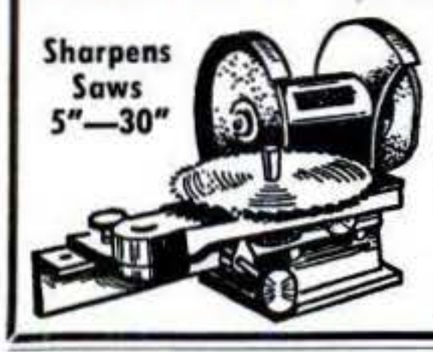

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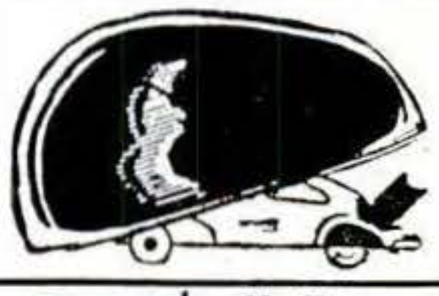

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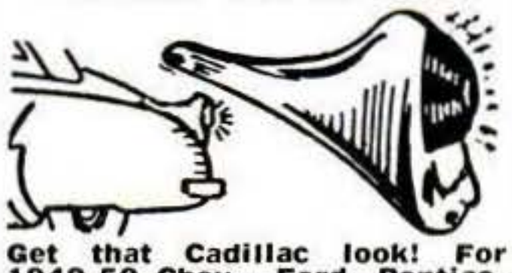

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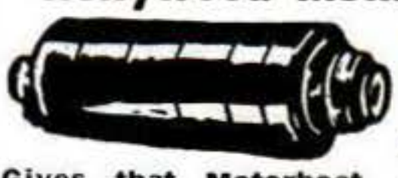

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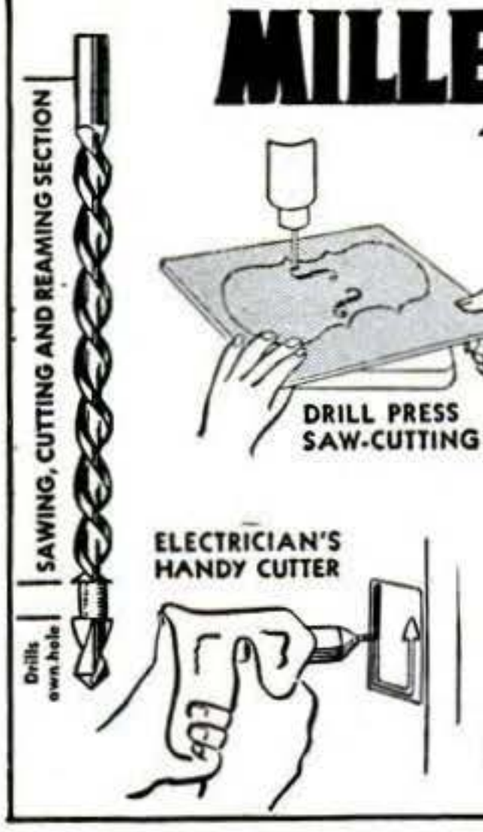


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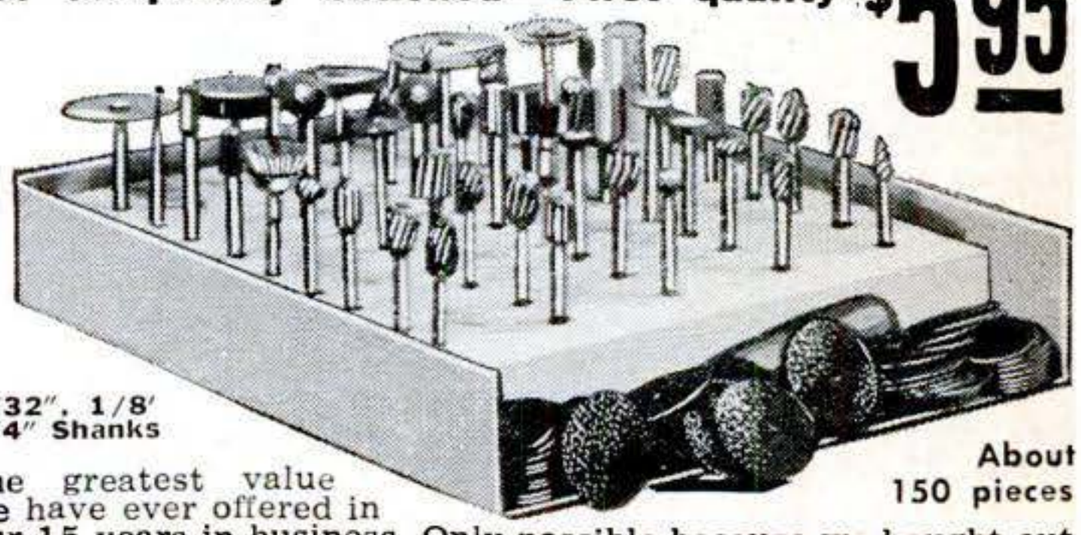

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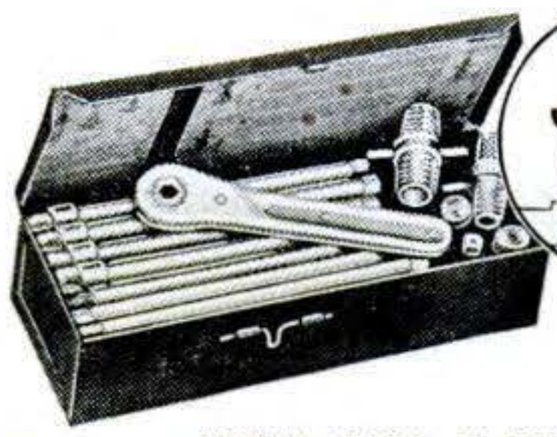

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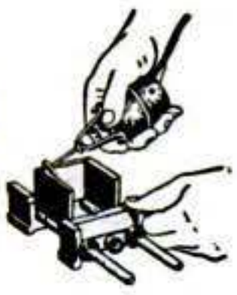

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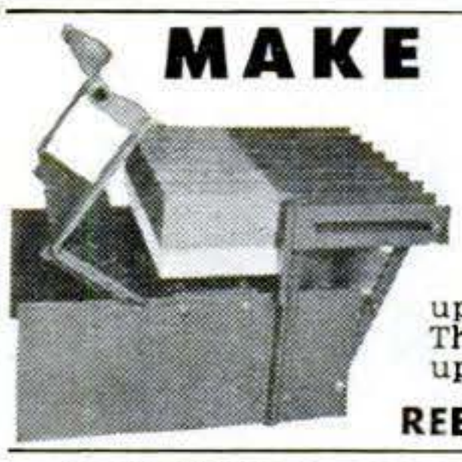

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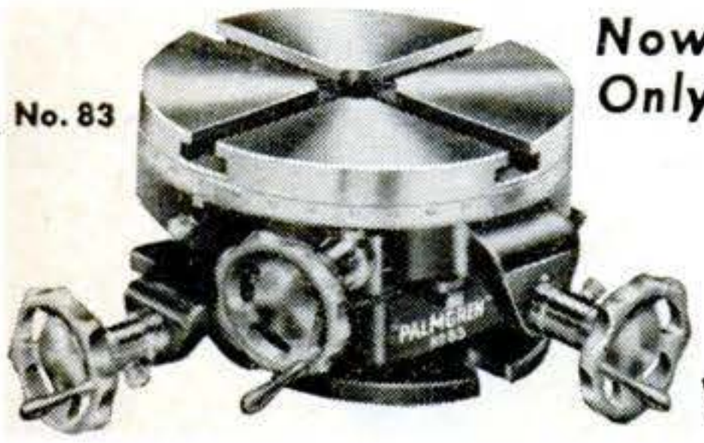


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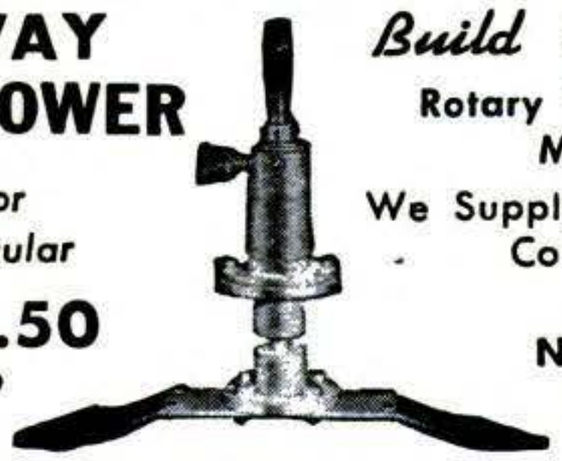

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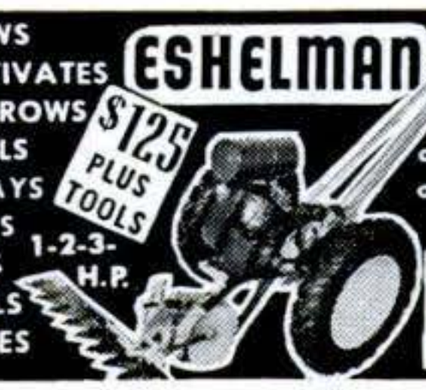

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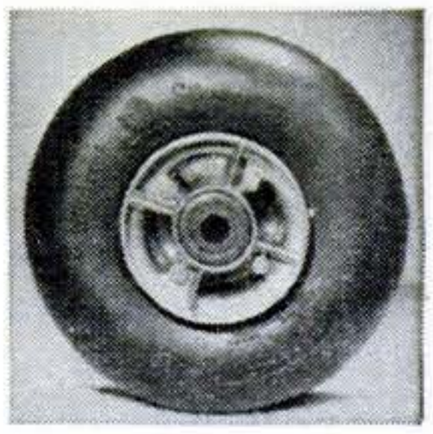

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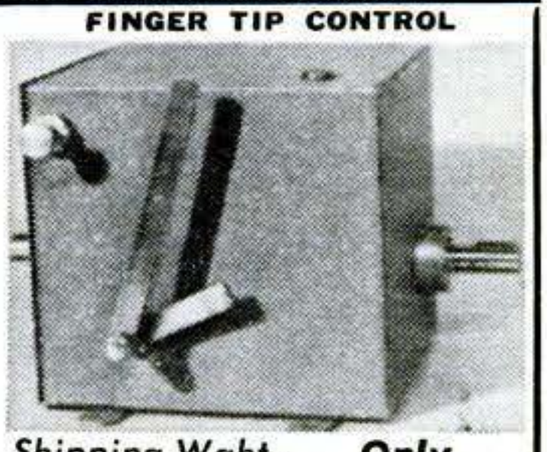

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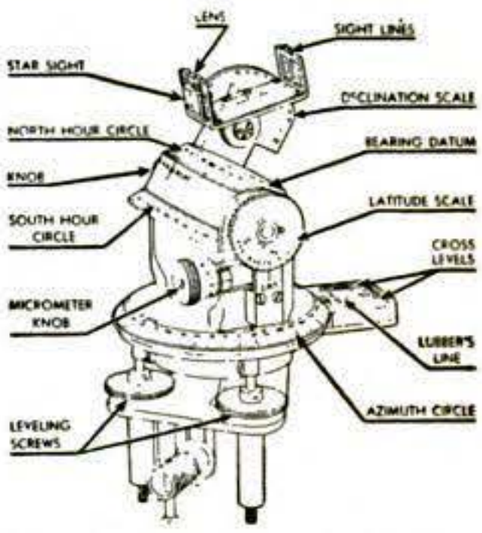


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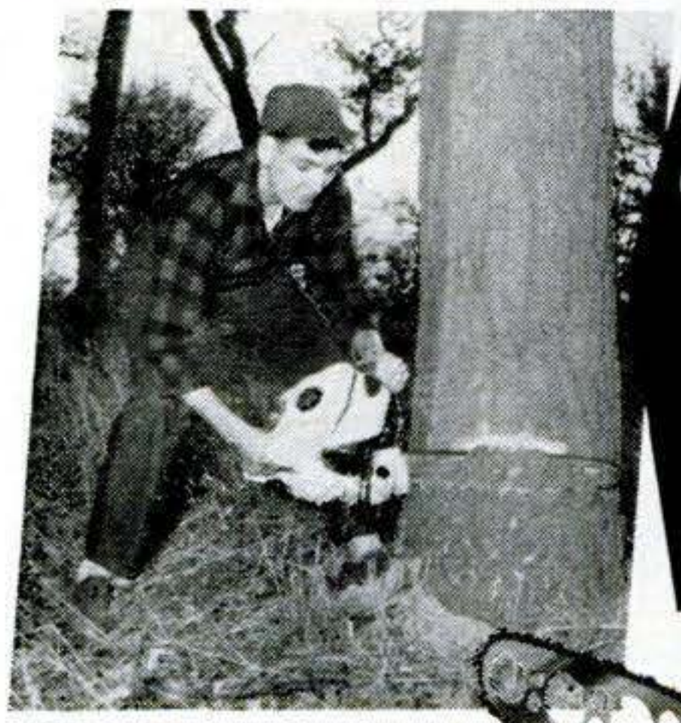

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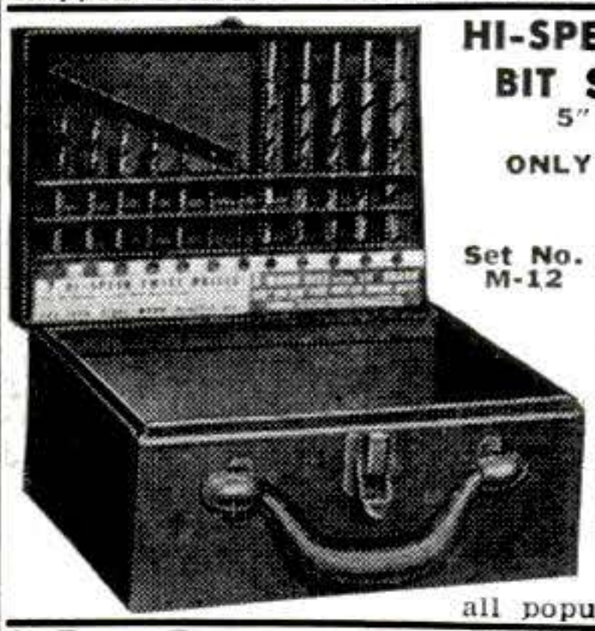

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5" x 7" x 11" 22 ga. Steel COMPLETE

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Drill rack provides holes for 6 intermediate 32nd sizes. For Iron, Steel, Wood, Plastic, etc.

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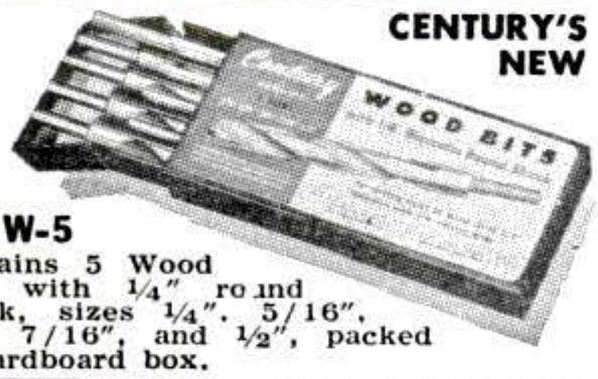


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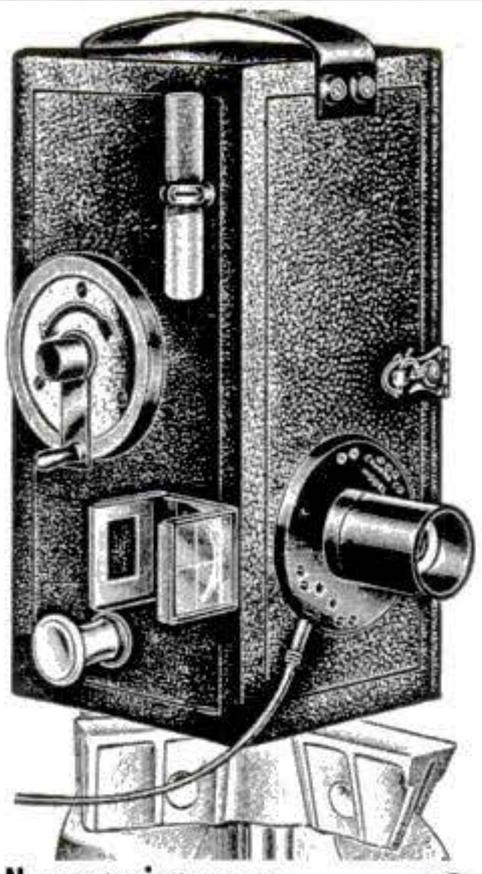

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**$299** *No Extras to Buy*

The Mulsifier Rotary Soil Tiller! Unsurpassed for tilling and cultivating. Makes it easy to work 1 to 20 acres. Prepares the soil in one operation. Nothing to do but guide it. High-powered—adequate for all soils. Unbreakable tines. Gives you more horsepower per dollar than any other garden tractor. Attachments available. Money-back guarantee. Send postcard for circular.

**MULSIFIER IMPLEMENT CO.**
**7760 HAMILTON, DETROIT 2, MICH.**

*Trade Mark Reg. U. S. Pat. Off.

*Free CIRCULAR*

*Mulsifier** **ROTARY SOIL TILLER**

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# New BELT SANDER ONLY $10.95

MODEL 324

***Stationary and Portable***

Ideal all-purpose sander for home or shop! Stop-Fence Unit adjusts to 4 positions — tilts to 45°. Sturdy aluminum construction. May be powered by electric motor, drill, lathe, etc.

*Send for free circular* **NOW!**

**JOHNSON Mfg. Co., Dept. 2C, Lincoln Park 7, R. I.**

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**Ask Your Hardware Store for**
# FULLER'S
***Unbreakable Amber Handle***
**SCREW DRIVERS**

America's most popular line of moderately-priced screw drivers! Wide range of sizes.
**FULLER TOOL CO., Inc., 911 Faile St., New York 59**
*World's largest maker of Amber-Handle Tools*

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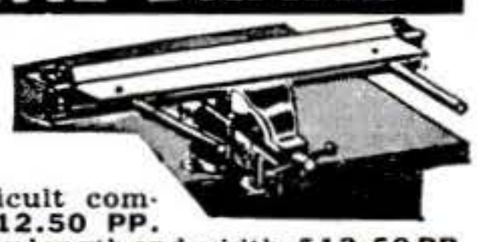
# 30" SHEET METAL BRAKE



Forms angles, hanges, seams. Bends 26 gage steel. Heavier copper and aluminum. Cam locking. Portable, can be clamped to edge of truck. All steel. Wt. 42 lbs. Express collect..... **$24.50**
36" size .....$29.00
**12" BRAKE.** Fits in vise to form difficult compound bends, up to 20 gage steel. **$12.50 PP.**
**CUTTER.** Cuts 18 gage steel any length and width. **$12.50 PP.**
**SHEET METAL PLIERS.** 2½" wide, **$2.00**; 5", **$3.00.**
**IRON BENDER.** Forms hooks, braces, eyelets. Bends ¼x2. **$10.00.**
*Immediate delivery. Order cash or C.O.D., or send for folder.*
**VISE BRAKE MFG. CO., S1116 So. 27th St., Omaha 5, Nebr.**

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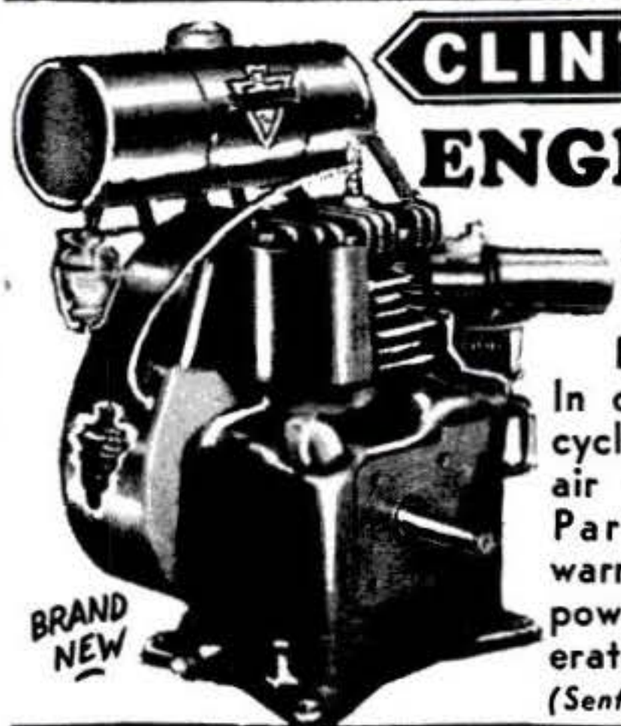
# NEW! ..SENSATIONAL VALUES




**CLINTON ENGINE 2 H.P.**

WAS ~~59.50~~ ONLY **39.95**

**BRAND NEW!**
In original factory cartons. 4 cycle, complete with gas and air filter, starter rope, etc. Parts manual and factory warranty included. Dependable power for mowers, saws, generators, etc. 37 lbs.
*(Sent express collect)*

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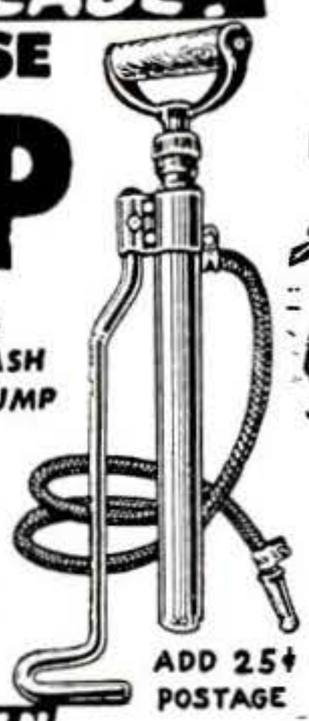
## GOV'T RELEASE!
# ALL PURPOSE PUMP



- *INSECTICIDES* • *BAILING*
- *FIRE FIGHTING* • *CAR WASH*
- *WHITE WASH* • *BILGE PUMP*

*etc.*

***BRAND NEW!*** Finest quality, easy working! Ruggedly built of all metal, wood grip! Complete with 10 ft. flexible hose, spray nozzle. Approx. 27" high.

ADD 25¢ POSTAGE

WORTH..... $3.98

**$1.39**

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## SURPLUS BARGAIN
## *BRAND NEW!* 5 GALLON *GASOLINE CANS*

**ONLY $2.95 O.D.**

***Genuine U.S. Army Olive Drab***
**"JEEP" CANS**
Factory fresh! Heavy gauge steel, screw top. Not water cans or reconditioned gas cans, but BRAND NEW gas cans as received by the government from the factory. Sent Express Collect.
"Jeep" Cans in red enamel.....$3.25
New Flexible "Jeep" Nozzles.....ea. 59c
9'x9' New Wall Tents ..... 27.50

SURPLUS BARGAINS
SEND 10¢ **for NEW! Spring and Summer Catalog**
**Over 500 surplus BARGAINS in sporting and camping goods, clothing, tools, etc. *Write for Your Catalog Today!***

**FISLER SALES CO.** 723 WALNUT KANSAS CITY 6, MO.

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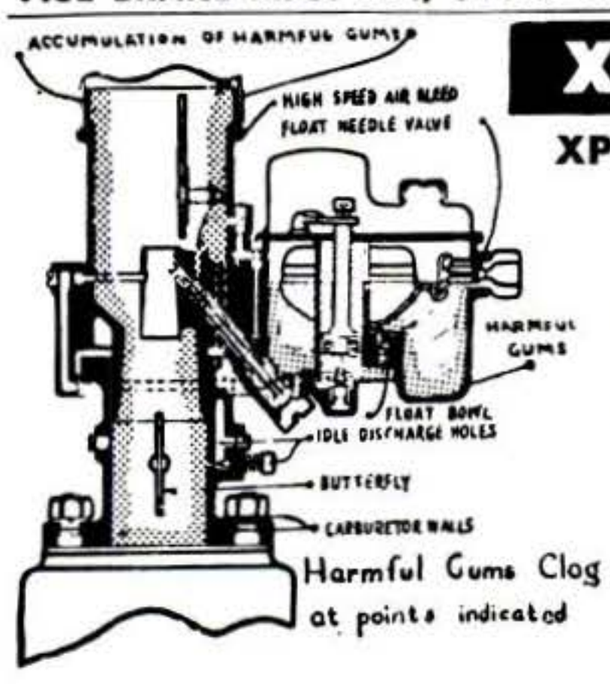


Harmful Gums Clog at points indicated

# XPEL-IT GIVES JET POWER TO YOUR CAR

**XPEL-IT INJECTOR KIT** *Removes Harmful Gasoline Gums.*

Does your carburetor need cleaning?—Modern gasoline contains harmful gasoline gums that accumulate in the carburetor and manifold of your automobile—new or old—robbing your car of power, wasting gasoline and money. Remove these gums with XPEL-IT INJECTOR KIT and give new life to your car! Don't spend $7.00 to $10.00 to take off and "boil out." XPEL-IT Injector Kit puts XPEL-IT **inside** carburetor and manifold—removes **all** harmful gum accumulations in 20 minutes—no experience needed—you notice the difference when you DRIVE JUST ONCE AROUND THE BLOCK. Don't remove carburetor to clean it—Use XPEL-IT—saves time and money. Satisfaction guaranteed or your money back. Complete XPEL-IT Injector Kit only **$2.00** postpaid—C.O.D.'s accepted.

**EXCELO SALES COMPANY**
**Dept. 14, 4163 W. 3rd Street, Los Angeles 5, Calif.**

- **SAVES MONEY**
- **CLEANS CARBURETOR AND MANIFOLD INSIDE WITHOUT REMOVING**
- **GREATER SPEED**
- **MORE POWER**
- **GREATER GAS MILEAGE**
- **GUARANTEED RESULTS—OR YOUR MONEY BACK**

**COMPLETE XPEL-IT INJECTOR KIT ONLY $2.00 POSTPAID**



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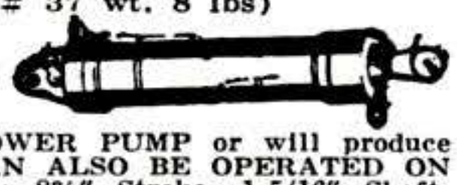
# TERRIFIC SURPLUS BARGAINS

**Stratopower Constant Displacement High Pressure HEAVY DUTY PUMP** Brand New. For operating Hydraulic cylinders, Hydraulic motors on tractors, bulldozers, constructions machinery lift trucks, fuel or oil transfer. Industrial Applications etc. Delivers up to 400 G.P.H. at 3750 R.P.M. Rated 1250 to 1400 P.S.I. 3750 to 4500 R.P.M. Has BUILT IN RELIEF AT HEAD. Rotation either direction Without ADJUSTMENT. Can be used as Hydraulic motor. $85.00 value only **$12.50**
(Stock # 37 wt. 8 lbs)

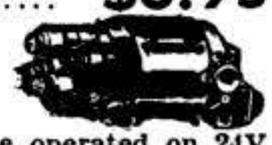


**NEW HYDRAULIC CYLINDER SPECIAL** Gives 17584 lbs. thrust (push-pull) using 1400 P.S.I. line pressure as obtained from our STRATOPOWER PUMP or will produce 34168 lbs. with 3000 line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE Air system. 4" Bore 8¾" Stroke, 1-5/16" Shaft. Clevis mounting. Ideal for road, Farm and Shop, machinery etc. Approx. Gov't cost $300.00. Only..... **$19.50**

**UNLOADING VALVE** Brand new Vickers. By passes full amount output of the pump while the cylinder is not in operation. Takes starting load of electric motor driving the pump. Price..... **$4.95**

**ACCUMULATOR** Brand new Vickers. For constant pressure both in line and reserve storage. For instant use to take lag from the pump. Ball type, Diameter 5½". Cap. 2000 lbs. pressure. Price..... **$6.95**

**BENDIX ELECTRIC HYDRAULIC SWITCH.**
Brand new acts as an electric shutoff–turn on. Here is a hydraulic pressure switch with extra heavy contacts. Ideal for automatically starting and stopping motor used to drive hydraulic pumps. The cutoff pressure is adjustable. The switch operates the pressure automatically. Use it as Safety, or load limit, device. Great Saving at our low price. Postpaid..... **$6.95**



**ADEL SELF PRIMING PUMP** Compact, small, Brand new, for pumping light oils, Aquarium, fluid metering, fuel pump, tool post grinder, coolant pump, pressure lubricating pump, general industrial use. Double ball bearing series wound motor, continuous duty. Can be operated on 24V A.C. D.C. Rated 30 G.P.H. A $50.00 Value. Postpaid.. ..... **$7.95**

**WAR SURPLUS BARGAIN SPECIAL**
**Brand New Vacuum -Air GENERAL PURPOSE PUMP -ARO PUMP**
May be used for Pressure or Vacuum. Standard ½" female pipe thread with interchangeable ports. Will pump 300 G.P.H. at 2000 R.P.M. 60 P.S.I. Vane type. Runs forward or reverse. Spline terminal for direct drive or pulley. Recommend ¼ H.P. motor or stronger motor as source of power. Use them for **Spraying Machines, Milking Machines, Compressors, Vacuum Pumps, Manure Loaders, Etc.** Cost $45.00. Now Only..... **$6.95**

**ELECTRIC MOTOR** ¼ H.P. 27VDC. R.P.M. 4000 # 750. For intermitent or continuous duty. ⅝" Shaft. **Variable Speed Motor can be Adapted to 110 V. A.C. or R.E.A. line** by simply arranging armature brushleads. UNUSED. Instructions incl. **$5.50**

**NEW CUNO OIL FILTER,** aircraft type. **Filters oil without cartridge replacements.** For Autos, Trucks, etc. Install at home in a few minutes. STOP CHANGING MOTOR OIL. Instructions incl. Ea..... **$4.95**

**WRITE FOR HYDRAULIC LISTING**
*Send check or Money order. No c.o.d.'s. Prices f.o.b. K.C. except when marked post paid*

**GENERAL SALVAGE COMPANY**
**Dept. 27, 2922 E. 27th St. Kansas City, Mo.**

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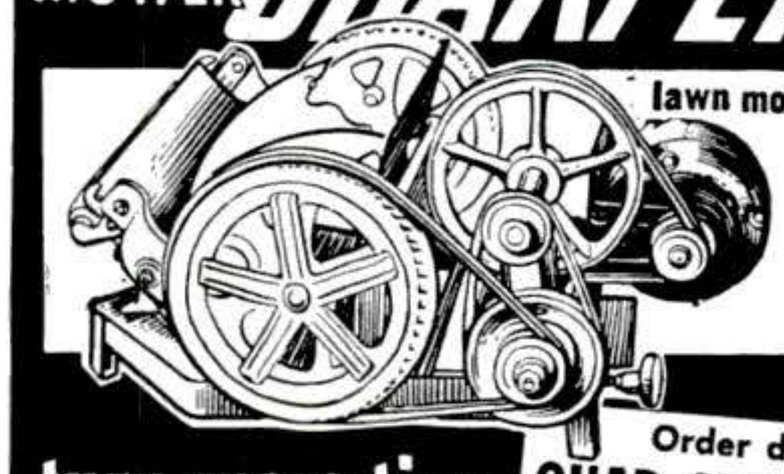
# LAWN MOWER SHARPENER



lawn mower sharpening at low cost!
**$47.50**
less motor.

**turn spare time into dollars**

Order direct from
**QUAD CITY PRODUCTS Company, Inc.**
**Box 42, Rock Island, Ill.**

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# HEAVY CAST ALUMINUM BLOWER, NOW ONLY $9.75

**SINGLE EXHAUST BLOWER, DELIVERS APP. 100 CFM.** For workshops, labs, kitchens, refrigeration, air conditioning. Ready to install yourself with any household tools. 110V AC 50-60 cycles cont. duty motor.
**DOUBLE EXHAUST BLOWER**—with 2 housings on extended shaft motor. Now **only $15.**
**Also LARGE 275CFM BLOWERS.**
**DUST-O-VAC**—Picks up & bags shavings and dust from all machines **only $19.95.**
**FREE Literature.** Send check, M.O. All shipments F.O.B. Yonkers, N. Y. Pay postman delivery charges.

**UNIVERSAL YONKERS CORP., (P4) 137 Alexander St., Yonkers 2, N. Y.**

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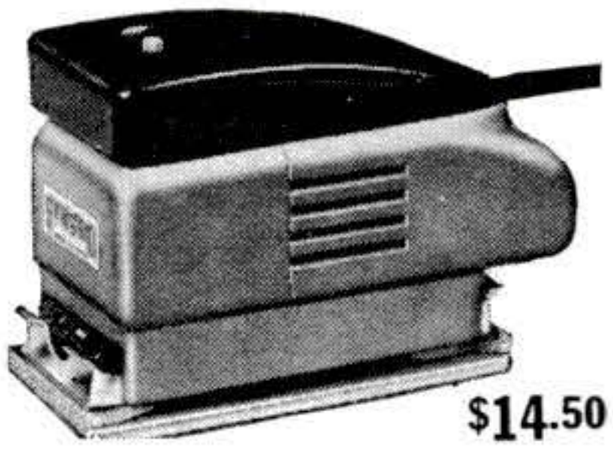
# SYNCRO ELECTRIC SANDER - POLISHER



Exclusive Double Arc Motion sands, polishes, massages! Just guide it. Comparison proves it best. With 10 sandpapers, 2 polishing pads, cord, plug. $14.50 at dealers or postpaid from **SYNCRO CORP., Dept. PM-45, Rochester, Mich.**

**$14.50**

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# NITE-LITE 4.97

Genuine **Radium-Active** painted numerals & hands on black ebony dial glow in darkness. Accurate Swiss movement. Sweep-second hand. Unbreakable crystal. Ultra-modern case. Takes hard wear! **1 YEAR GUARANTEE.** Send $4.97 plus 50 cents fed. tax for quick delivery. C.O.D.'s plus postage. Money back in 10 days if not thrilled!

**THORESEN Direct Sales**
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# EASY TO DETECT URANIUM

**$10,000 Government reward, a guaranteed market and profitable prices are yours for the discovery of Uranium . . . easy to detect with the Keleket "Prospector". Simple to operate. This durable, 2 lb. prospecting instrument costs less, is made by company famous for 50 years. Complete with headphones.**

**DEALERS: Write for excellent proposition and open territories.**

**PRICE $48.50 F.O.B. Factory**

**The KELLEY-KOETT INSTRUMENT DIVISION, 18-4 E. 6th St., Covington, Ky.**

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# NEW! SPECIAL 18" LEVEL For Home Craftsmen!

**UNBREAKABLE FRAME OF EXTRUDED ALUMINUM ALLOY!**

Not **cast** aluminum! Frame is **extruded** aluminum alloy. Will not break. This Scharf 18" Level made specially for Home Craftsmen. Straight, parallel, absolutely accurate, large hand-holds, extremely lightweight. Beautifully designed, gracefully streamlined. Has 6 vials. Greatest level ever built!

**Adjustable and Replaceable Vial Units**
Finest, die cast, vial assembly. Vial units attached to level by screws. Easily adjusted or replaced entirely if damaged by accident.

**BIG VALUE!**
Get your Scharf 18" Home Craftsmen Level today. **$4.50** If your dealer can't supply you, order from us direct, but you must send dealer's name and address. Satisfaction guaranteed. If you send money order or draft, mailing charges will be prepaid. If C.O.D., mailing charges will be added.
*"We Make All Sizes of Levels"*
**J. H. SCHARF MFG. CO.**
**Dept. P.S.3, Omaha, Nebr.**

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# "WOVEN-Gards"

**BETTER**
## Hand Protection at Amazing Low Cost

"Woven-Gards" are hand protectors, mitts, pads and sleeves made out of a wholly new safety material to provide flexibility, comfort, resistance to abrasion and cutting far beyond that of anything used before. They are extremely oil-absorbent for excellent handling of oily, slippery sheets and slabs. The porous weave makes them the best "hot" handlers ever offered. Thousands of enthusiastic users say they have never seen values like "Woven-Gards," best protection at lowest cost. Send *now* for descriptive folder and prices.

**INDUSTRIAL GLOVES CO.**
**1428 Garfield St., Danville, Ill.**
(In Canada: Safety Supply Co., Toronto)



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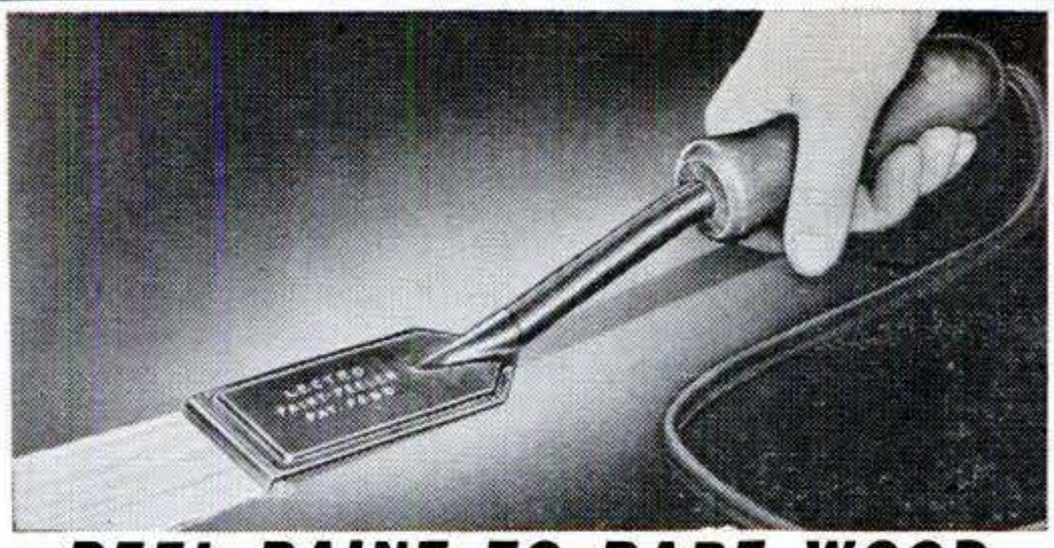

## PEEL PAINT TO BARE WOOD WITH ONE EASY STROKE

NEW ELECTRICAL TOOL removes 1 to 10 or more coats of paint from any wood surface as easy as cutting butter with a hot knife. No scraping, cutting, burning, sanding, or chemicals. The new Lectro Paint Peeler instantly softens paint electrically and peels it off the surface clean to the bare wood with one easy stroke. It's faster than a blow torch—there's no danger of fire—will not scorch or burn delicate wood surfaces. Makes no mess—no smell—it's even fun to use. Removes any paint, enamel quickly and easily. Sturdily constructed to last for years. Sent complete with extra long, quality electrical cord. Simply plug into any A.C. or D.C. outlet—let heat for several minutes and remove paint to the bare wood on exterior or interior painted surfaces, floors, woodwork, cupboards, furniture, antiques, boats, window-sills, screens, doors—a hundred other uses. Price $4.95 postpaid—nothing else to buy. Full money back guarantee. For immediate shipment—send check, cash or money order to:

**LECTRO WELD, INC.**
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## The Modern PLASTIC for lasting Home Repairs

PERMANENTLY mends cracks or holes in wood, tile, stone or plaster. Sticks and stays put—Does not chip, shrink or fall out. Easy to use. Economical. Mold it, chisel it, polish or paint it. If unobtainable from your lumber, paint or hardware dealer, the big 4-lb. can will be sent you postpaid (in U.S.) for only $1. Full money-back guarantee, order now.

**DONALD DURHAM CO.**
**Box 804-P, Des Moines, Iowa**

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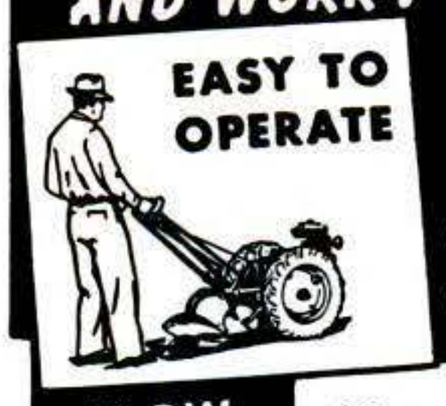
## SAVE TIME AND WORK! MAKE EXTRA MONEY!



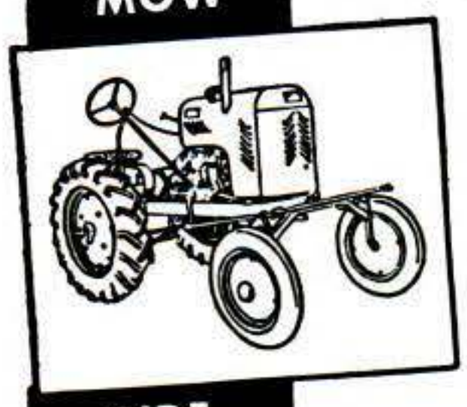

## SHAW "DU-ALL" and "PEPPY PAL" GARDEN TRACTORS

PLOW

HARROW

CULTIVATE

MOW



RIDE

RW-2

**SHAW MFG. CO.**

These sturdy walking and riding tractors ideal for dozens of uses around the farm, orchard, garden, golf course, estate and poultry farm.

**DO DOZENS OF JOBS**
Shaw Du-All or Peppy-Pal tractors do many jobs quickly and easily. Plow, cultivate, harrow, mow, disk, bulldoze, spray, grind, haul and saw wood. New uses discovered every day.

**BUILT FOR RUGGED WORK**
Sturdy, extra-strength construction means low upkeep, long life. Patented tool control allows quick shift for crooked rows. Attachments easy to change with new "Jiffy Hitch."

**CHEAP TO OPERATE**
Operates on few cents an hour. Soon pays for itself in time and labor-saving plus low initial and operating costs.

**NEW LOW PRICES**
Buy direct or through your dealer! Almost anyone who has a garden can afford a Shaw Du-All or Peppy-Pal. Full year's guarantee.

**RIDING TRACTORS**
Four models, from 5 to 12½ H.P., 58 in. wheelbase, 36 in. wide, 24 in. plant clearance. Hand or electric starter. Improved steering device, brakes enclosed in differential housing shaft. Standard hitch for trailers and wagons. Plow, harrow, cultivator, cutter bar, snow plow, bulldozer available.

**PROMPT SHIPMENT**
No waiting—order now for immediate delivery.

**FREE:** Illustrated folders giving complete details and price lists. Write today.

5704 Front St., GALESBURG, KAN.
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Dealer Inquiries Invited

## SET THE PACE WITH THE Powell P-81!

- Cruises at 45 MPH—with faster pickup than car
- 39" high, 71" long overall, wt., 190 lbs.
- 8 HP motorcycle engine
- 50 miles to the gallon
- Automatic clutch
- Internal expanding brakes — handle-grip throttle controls

ONLY $247.34 AT COMPTON, CALIF. EXCISE TAX INC.

**POWELL MANUFACTURING COMPANY**
**DEPT. PS-450 • COMPTON, CALIF.**

Write for FREE folder and name of nearest dealer

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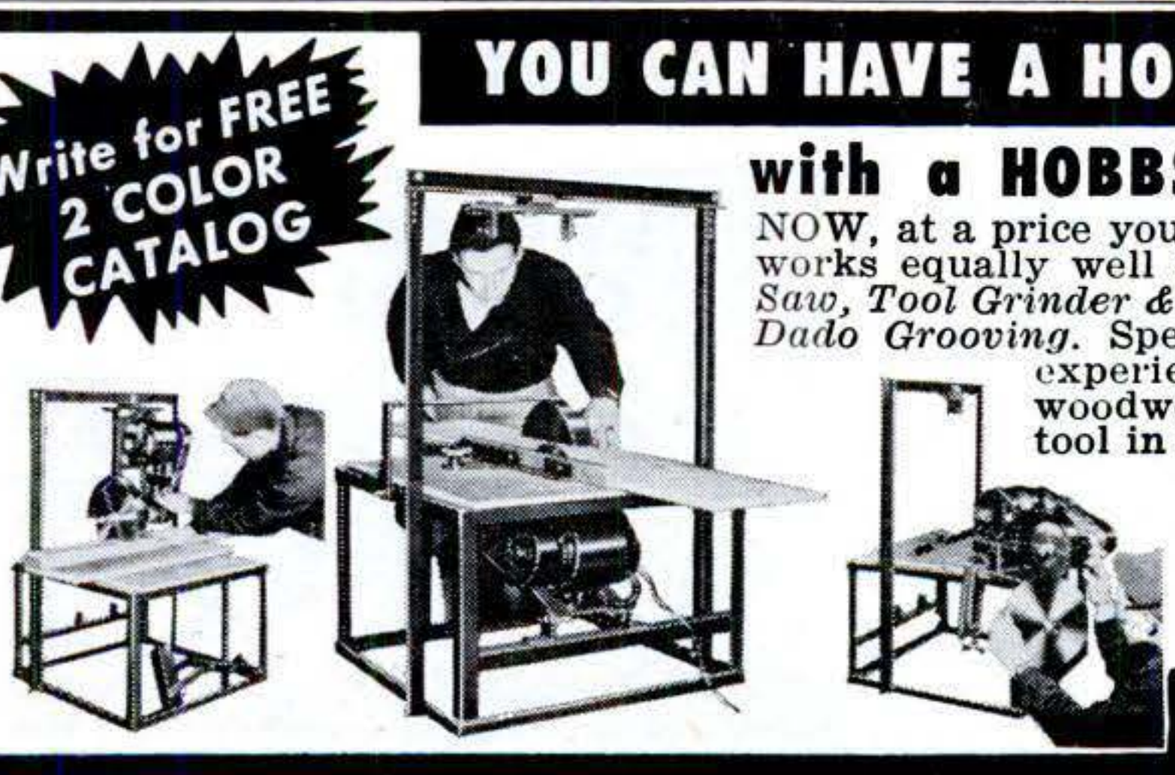
## YOU CAN HAVE A HOBBY AND A BUSINESS TOO!

Write for FREE 2 COLOR CATALOG



### with a HOBBS No. 64 6-IN-1 SAW SHOPETTE

NOW, at a price you *can* afford, a rugged, 6-in-1 power machine that works equally well as a *Table Rip Saw, Swing Cut-Off Saw, Mitre Saw, Tool Grinder & Polisher, Saw Gummer & Sharpener and also for Dado Grooving.* Specifically designed by a company with 40 years experience for home workshops, saw shops, fix-it shops, woodworkers, carpenters, etc. Converts from tool to tool in minutes. Completely portable. *Guaranteed.* Start your own home workshop or a money making business with a SHOPETTE. Increase your profits if you now own a shop. Power unit & table complete with motor *plus* 10" rip saw, 10" cut-off saw & emery wheel only $128 F.O.B.

**P. T. HOBBS MACHINERY**
**8375 N. INTERSTATE, DEPT. PS-40, PORTLAND, OREGON**



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ROTARY WOOD PLANER $7.50

1" and 2½" DRUM SANDERS

ROTARY SURFACE SANDER $5.95

$9.85 F.O.B. Detroit
ALL-METAL DRILL PRESS TABLE

ALL-METAL SHAPER FENCE
$8.25
F.O.B. Detroit

ROUTER & MORTISING BITS
$9.50
per set of six

SHAPER CUTTERS
$9.00
including
3 sets Blades

## 15 ESSENTIAL WORKSHOP OPERATIONS . . .

You can convert any standard make drill press into your most versatile, useful, low cost workshop tool. Barron Precision Tools now enable you to perform 15 indispensable shop operations—surface-plane woods and plastics — rabbet — tenon — panel — bead — groove — bevel — mortise — route — cut dovetail — sand surfaces and contours — shape — cut moldings—grind and buff. Over 200,000 Barron Tool users. Every tool sold on full 10 day money back guarantee.

***See Your Dealer . . . Or Write Direct***

**BARRON TOOL COMPANY, INC.**
**870 Architects Bldg., Detroit 1, Mich.**

**FREE Workshop Guide & Catalog**

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## SENSATIONAL BARRON SPEED-VISE!

**PERMANENT—PORTABLE**

Slickest, handiest, most useful all-metal work bench vise. A workshop "must" for—
PLANING • SAWING • DRILLING • SANDING • FILING • ETC.

**Only $1.75** Include 20c for shipping

Won't mar, mark or dent woods, plastics, metals. No piece too small or too large. 10 Day Money Back Guarantee.
**BARRON TOOL CO.** Dept. SP **DETROIT 1, MICH.**

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## CARBURETOR TOO RICH MAKES MOTORIST TOO POOR

**Car owners who are wasting money and not getting proper gas mileage due to over-rich mixtures will be pleased to learn how to save gasoline by VACU-MATING over-rich mixtures. VACU-MATIC fits all cars, trucks and tractors. It is *automatic* and operates on the supercharge principle. Easily installed in a few minutes.**

**SALESMEN WANTED! Big Profits!**
Send name, address on penny postcard for *free particulars* and how to get yours for introducing.

**VACU - MATIC CO., 7617 - 1592 W. State St., WAUWATOSA, WIS.**

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## *Convert* HAND MOWERS TO POWER MOWERS

***Takes less than 3 hours***

The Handy-Dandy Lawn Mower Kit fits any hand mower from the 16 to the 20 inch size. Complete with all necessary parts. Kits can be purchased separately, complete with engines or complete with Pennsylvania mower.

Also manufacturers of a complete power mower and garden cultivator attachments.

**DEALERS WANTED**

**LE CLAIRE MFG. CO.**
**LE CLAIRE, IOWA, Dept. PS**

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## *SO EASY TO STRIP PAINT*

To get good results, strip off all cracked or peeling paint. It's easy when you use Wonder-Paste. This powerful paste-like remover, applied with a paint brush, softens up paint, varnish, lacquer, shellac, etc. Turns it into a soft sludge that comes off easily. Leaves surface in perfect condition. Harmless to hands. At leading paint and hardware stores.

**Write for WONDER-PASTE leaflet**

**Wilson-Imperial Company, 121 Chestnut Street, Newark 5, N. J.**

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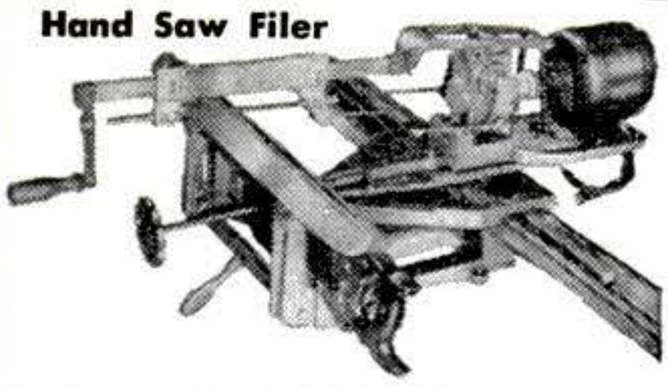
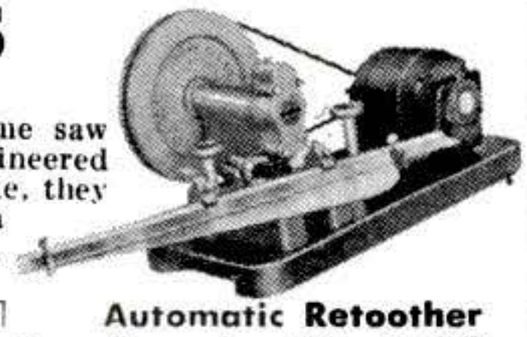
Hand Saw Filer



## EARN BIG PROFITS

**SHARPENING AND RETOOTHING SAWS**

Gain INDEPENDENCE & SECURITY with a full or part time saw shop . . . A BUSINESS OF YOUR OWN. Burr's precision engineered hand saw machines help you do a better, faster job. Easy to operate, they give a life-time of service. Each machine is fully backed with a one-year guarantee against defective workmanship or materials.



Automatic Retoother

**WRITE FOR FREE FOLDER ON**
**Hand Saw Filer ☐ Automatic Retoother ☐ Both ☐**

**BURR MFG. Co. Dept. 4 8943 Venice Blvd. Los Angeles 34, Calif.**

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## Is Your Basement a Morgue for Old, Dried-up, Useless Paint Brushes?

ELIMINATE BRUSH CLEANING . . . no drying . . . keeps brushes hermetically sealed . . . FLASH SEAL BAGS. Big money-saver . . . astounding new development . . . a special plastic . . . becomes absolutely airtight with a single match. FLASH SEAL BAGS will hold all sizes of brushes, including big 4½ inch size. NOW no need to clean the brush when finished painting, just slip it into FLASH SEAL BAG, add teaspoon of linseed oil or turpentine, seal airtight with a match.

**EASY TO SEAL—INSTRUCTIONS INCLUDED—GUARANTEED**

Eliminates ruined paint brushes, avoids drying out . . . keeps brushes soft and ready to re-use for years. BAGS can be RE-USED OVER and OVER. Economical, practical . . . save money . . . get better paint jobs.

**BAUER-LEE & COMPANY** Box 3436, Merchandise Mart, Chicago 54, Ill.

**SPECIAL OFFER!**
1 BAG ONLY **25c**

**SAVE MONEY**
Order 7 bags ONLY **$1.00**

*WE pay postage*
*No C.O.D.'s please*



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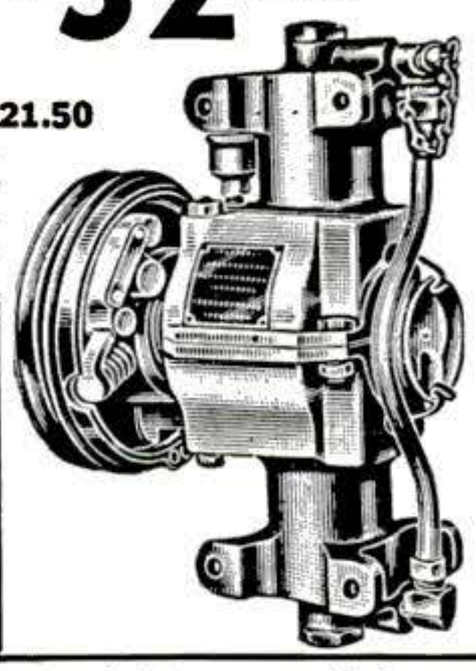
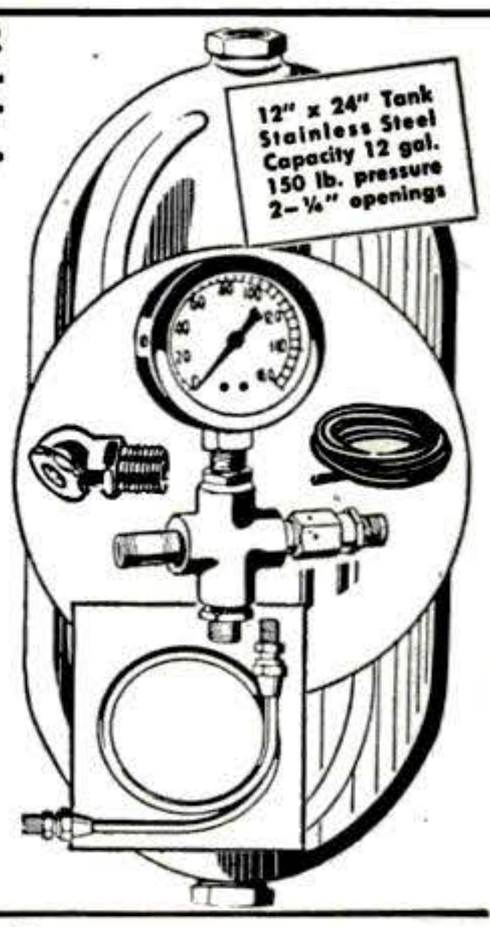
# "Wellworth" Sensational Offer! Reg. $60.50
# WESTINGHOUSE AIR COMPRESSOR

**Model T-1 Brand New — 2 CYLINDER PISTON TYPE. Operates with ½ H.P. Motor or equivalent gas engine.**

**$32.50**



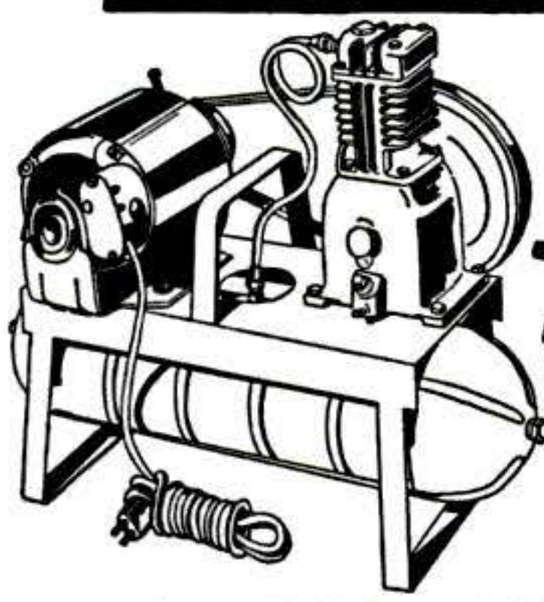



**Compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples. COMPLETE OUTFIT, wt. 52 lbs.**

**Equipment less Compressor, $12.50. Compressor separately, $21.50**

Compressor has 2" bore, 1½" stroke, ball bearing, 3.27 CFM at 600 R.P.M. Capacity up to 6.54 CFM. Size 9"x11⅞"x6⅝". Wt. 26 lbs. Ideal for spraying paints, insecticides, etc., inflating tires, operating air tools, and other uses. All new equipment. U.S. government surplus. Replacement parts available. Amazing buy. Don't miss it.

## PORTABLE SPRAY OUTFIT



**INCLUDES ¼ H.P. HEAVY DUTY MOTOR**

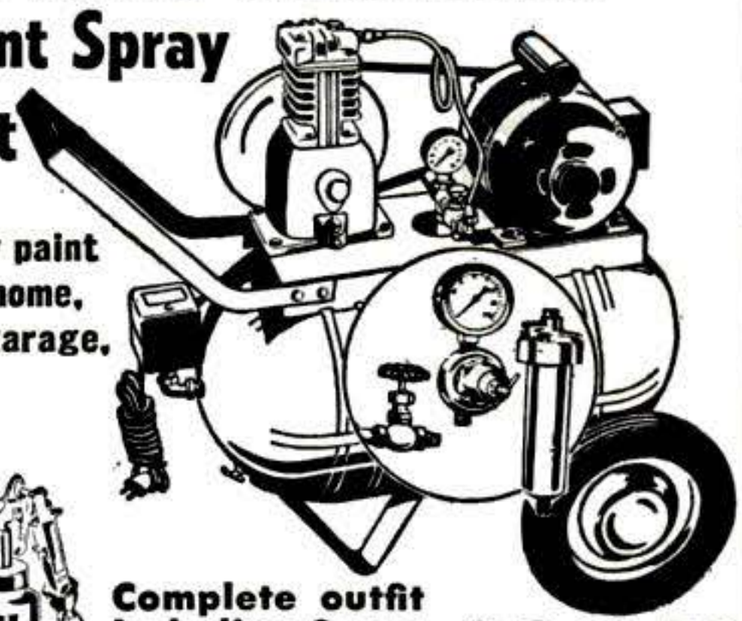
**EXTERNAL ATOMIZING GUN**

Paint Sprayer mounted on 6 x 24 inch tank, ¼ H.P. 110 V. 60 cy. Heavy duty motor with overload relay, 10 ft. cord and plug, V Belt drive. Piston-type Compressor with 2 Compression rings, 1 oil ring, 2 inch Bore, 1¾ inch stroke, displacement 2.86 C.F.M. at 60 lbs. pressure, Safety Valve. Gun **external atomizing.** Flat and round spray, quart cup; maintains 35 to 40 lbs. working pressure Oil and water extractor, 1 air gauge, 20 ft. heavy duty 2-braid air hose with leak proof fittings, complete with carrying handle. Net weight 54 lbs., ship. wt. 60 lbs.....

**$57.50**

**Outfit less motor.....$47.50**

## Portable Automatic Paint Spray Unit



**Spray paint your home, car, garage, etc.**

**Complete outfit Including Spray Gun. $150.00 Value.**

**$89.50**

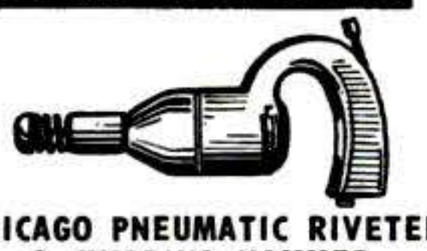
**Same unit, stationary, $79.50**

Use also for spraying insecticides on plants and flowers. ⅓ H.P. heavy duty capacitor motor. AC 110/220 volt, 60 cycle, 2 x 1¾ inch piston type compressor, splash feed lubrication. 12½ x 24 inch tank, automatic pressure switch. CFM 2.8 at 100 lbs. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, spray gun with 20 ft. air hose and air chuck for inflating tires. V belt drive. Mounted on 2 wheels, ball bearing, with 2" x 10" pneumatic tires. Portable, with handle. Shipping wt. 90 lbs. Regular $150.00 value. ONE YEAR GUARANTEE. Only $89.50 complete.

**PARTS SOLD SEPARATELY**

| | | |
|---|---|---|
| Compressor | 17.50 | wt. 16 lbs. |
| Automatic pressure switch | 7.50 | wt. 3 lbs. |
| Regulator, gauge and filter | 8.50 | wt. 5 lbs. |
| Spray gun | 9.95 | wt. 4 lbs. |
| Tank, wheels and base | 17.50 | wt. 32 lbs. |
| 20 ft. hose | 2.95 | wt. 6 lbs. |
| ⅓ H.P. Cap. motor | 22.50 | wt. 28 lbs. |
| Air gauge...1.75 Adjustable pop valve | | ...1.50 |
| ¼" check valve | 2.75 | wt. 2 lbs. |

## PNEUMATIC AIR TOOLS



**CHICAGO PNEUMATIC RIVETER & CHIPPING HAMMER**

CP4X Pistol grip handle. Takes up to 3/16" rivet. Weight 6 lbs. List price $73.00.

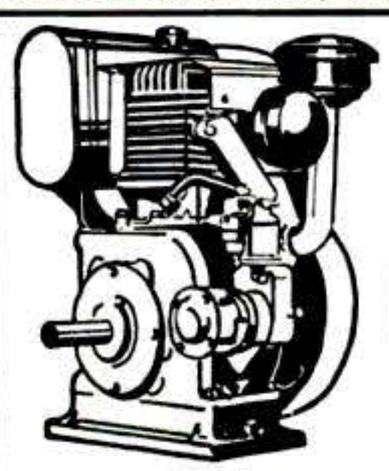
**Ideal for work on fenders and auto bodies**

**SPECIAL PRICE.....$10.95**

**Same as above, brand new.....$22.50**

**Ingersoll Rand AIR DRILL**

With ¼" Jacob Chuck. Wt. 2 lbs. List price $55.00. Only.....**$14.95**



## Save 33⅓% On GAS ENGINES!

***All Brand New Equipment***

Wisconsin Model VE4 with clutch H.P. 13 to 20.5 List $342.00 Price **$228.00**

Wisconsin Model AEH H.P. 3.3 to 6.1 List $130.95 Price **$87.00**

Wisconsin Model A.B. H.P. 1.7 to 3 List $90.00 Price **$60.00**

**GENERATOR and ENGINE FOR LIGHT PLANT**

Brand new! Generator and gas engine bargain! Climax Generator. 2500 to 3000 Watts 110 Volt A.C. with 6.1 H.P. Gas Engine. Wisconsin or Briggs & Stratton.

**$300.00 value**

**Price only..... $225**

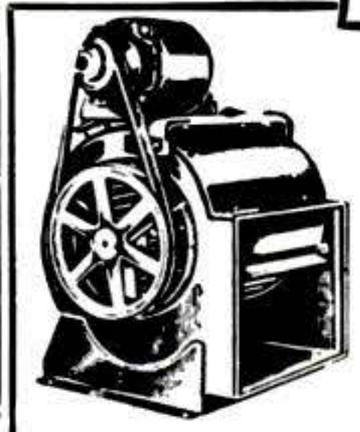
Reduced Price

**Only $14.50**

**6 FT. STOW FLEXIBLE SHAFT**

Heavy Duty, ⅜" Core. Best piano wire. Ball bearing handle and arbor, rubber covered housing; for ½" motor shaft; for ½" bore wheels. Operates on ¼ H.P. Motor at 1725 or 3450 R.P.M. $29.00 Value, **$14.50.** Wt. 8 lbs.

**All items advertised on this page are guaranteed BRAND NEW**



## "Wellworth" BLOWER *at a Bargain Price*

Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13⅛" x 11⅜"; inlet 8¾". Height 19". Width 18". Depth 16½". C.F.M. ¼" S.P. 1600; outlet vel. 1575; motor ¼ H.P. with overload relay; cord & plug, 110 v. 60 cy. AC. Ship. Wt. 67 lbs. Special price.....

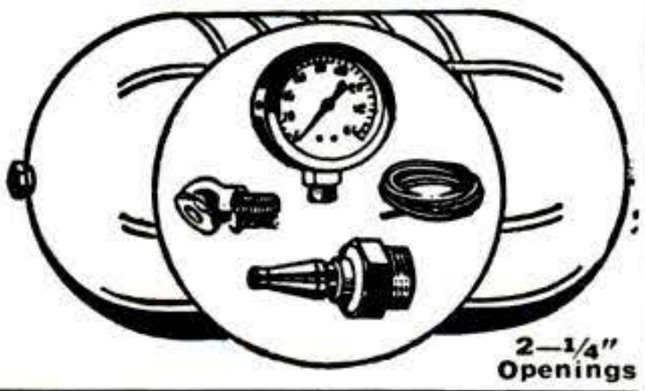
**$39.50**

## AIR TANK and ACCESSORIES

Air receiver, stainless steel, 12½"x24". 400 lb. test. Ideal for carrying on trucks, autos and wherever compressed air is needed. Equipped with 500 lb. air gauge, tire chuck, 3 ft. high-test air hose, air inflation valve with core for retaining pressure in tank, and fittings.

Complete outfit **$6.95**

Shipping wt. 20 lbs. Tank only.....**$4.95**



2—¼" Openings

## "Wellworth" V-BELT CLUTCH

Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts. 2.25" pitch diameter. ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3¼" long. Safe, easy to mount, sealed bronze bearings, positive action.

**$7.50**

**SUMP PUMPS. ALL SIZES. BARGAINS. SEE CATALOG**

Prices f.o.b. Chicago. Immediate delivery. All items sold on money back guarantee. Send check or money order today.

## SEND FOR OUR 68 PAGE BOOK

**A handy buyer's guide for home and factory workshop. Unusual bargains in motors, air compressors, electric tools, and many more items. Send 10c for postage and handling.**

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**1831 S. STATE ST. DEPT. B-4 CHICAGO 16, ILL.**



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# • BLAST DIRT WITH RICH SUDS!
# • KILL GARDEN PESTS!
# • ENRICH YOUR SOIL!

with the amazing new **SUDS-O-MATIC**

**Year 'round nozzle-washer-sprayer that fits any garden hose . . . $4.95**

**BLASTS DIRT WITH SOAP-'N-WATER!** No rubbing or scrubbing--water pressure does the work for you! Ideal for cleaning your car, house, screens, storm windows, porch, basement, patio, lawn furniture, rugs, etc.

**WAX PROTECTS YOUR CAR FINISH**—Wax impregnated detergent cuts grease and road film, gives your car a high lustre without hand polishing!

**SUDDEN DEATH TO INSECTS!** Spray DDT on your lawn, flowers, shrubs, porch, patio, basement, etc.—merely by turning on your hose!

**ENRICH YOUR SOIL!** Stimulate plant growth by spraying fertilizer on your lawn or garden and soaking it into the subsoil—all in one easy operation.

**USE IT AS A NOZZLE ALONE!** Turn lower nozzle on whenever you need rinse water. Adjustable from fine spray to steady stream.

At the press of a button, Suds-O-Matic does all the hard and dirty work for you. Fits any garden hose. Easy to load with pellets of detergents, DDT or fertilizer. Made of non-corrosive alloys, chrome-plated finish. Comes complete with package of Suds-O-Cleen and package of Film-O-Wax pellets, **only $4.95!**

**ORDER ADDITIONAL PELLETS**

5 Suds-O-Cleen pellets for cleaning . . . . . 24c
5 Film-O-Wax pellets for car wash . . . . . 49c
65 fertilizer tablets . . . . . $1.00
65 DDT pellets . . . . . $1.00

*Send cash, check or M.O. for prepaid shipment*

**BERTRUM E. ENGINEERING CO.**
3121 Main Street Kansas City, Mo.

***a complete shop in one precision machine!***

# The IDEAL LAWNMOWER SHARPENER

- sharpens hand and power mowers
- completely new—based on 48 years of lawnmower sharpener experience
- complete with bed knife grinder and lapping-in Reconditioner—all operated by same motor

You can do *precision* lawnmower sharpening faster and easier than ever before on the Model 300 Ideal Sharpener. No disassembling needed, place the entire mower in the machine. You can make more money and do better work with an Ideal. Get all the facts, compare, no other sharpener offers as much as the Model 300 Ideal.

*Write Today For Free Catalog*

**THE FATE-ROOT-HEATH COMPANY**
**DEPT. H-4, PLYMOUTH, OHIO**

No. 465972

WE'VE GONE BERSERK ON . . .

# BEARINGS

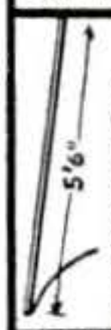
Needle, Roller, Recessed, Rod End, Shielded, Unshielded. Made by some of the WORLD'S FINEST MANUFACTURERS of BEARINGS!! These are the finest Precision Aircraft Bearings. YOURS at a FRACTION of commercial prices. NEW

| Description | O.D. | I.D. | Thickness | Price |
|---|---|---|---|---|
| | | SHIELDED | | |
| K-3 | .7774 | .1895 | .270 | 20¢ |
| K-4 | .9014 | .2495 | .335 | 25¢ |
| K-5 | 1.250 | .3120 | .375 | 35¢ |
| K-6 | 1.4375 | .3745 | .469 | 40¢ |
| K6AR-48 | 1-3/32 | 23/64 | 5/16 | 30¢ |
| | | NON-SHIELDED | | |
| 3L24BM | 7-3/32 | 4-23/32 | 1 1/8 | 7.50 |
| 209V | 3-11/32 | 1-3/4 | 17/32 | 1.95 |
| | | NEEDLE | | |
| B-1616P | 1-1/4 | 7/8" | 1" | 45¢ |
| B-3424 | 2½ | 1-7/8 | 11/32 | 1.25 |
| | | ROD END (Thread 3/8 x 24) | | |
| | I.D. | Length | Thick | |
| RE3M6A | 3/16 | 2" | 1/2" | 35¢ |

NOTE; We have 168 other sizes of New Bearings in tremendous quantities !!

SAVE! SAVE! SAVE! – We have TREMENDOUS quantities of AIRCRAFT Quality BOLTS – SCREWS – RIVETS & NUTS. Our huge stocks include a variety of sizes and lengths. PRICED LOWER THAN YOU PAY FOR ORDINARY COMMERCIAL QUALITY.

**NEW BRIGGS & STRATTON MOD. "A" GAS ENGINE** That nationally known "workhorse" of single cylinder engines! 2.10 HP–4 cycle, air cooled. Economical & Easy to Operate. Drives small pumps, boats & farm equipment. Brand New—Still in Original Crates . . . BS-A ONLY . **$59.95**




**GROUND ROD** Made by a leading manufacturer of electrical conductors. This rod is all new and in excellent condition. Most commonly used as ground conductor on high power lines, telephone poles, etc. Has solid iron core covered with non-rusting Copperweld. EA. **1.00**

**JUNCTION BOX** Formerly used in aircraft electrical circuits. Have many uses around home & shop. All brand new!!

13¼"x11½"x4"---.064 Alum. $2.75 ea.
12½"x10¼"x6"---.064 Alum. $2.69 ea.
7½"x 5"x 4"----.040 Alum. 99¢ ea.

**BATTERIES** A 9 Volt, Dry Cell unit. 3, wired in series will run a 24 or 27 Volt motor. Ideal for Lights, Boats, Portable Radios, etc. While they last. . . . **79¢**

**WHEELS** For Wagons, Dollys, Handtrucks, Wheelbarrows, etc., 10" dia., with 7/16" center hole. (can be drilled out to take 5/8" axle) Wheel is 1/8" steel with 10 x 1.75 heavy duty, semi-pneumatic cushioned rubber tire. . . . . EA. **$1.75**

**U S NAVY PHONE SETS** Used by the Navy for Flight Deck & Gunnery Control. Each set is complete with 2 phones, mounted on chestplate, 2 headsets, battery cases, push-button switches & 35 ft. of cable. Can be used successfully up to ½ mile distance. Power is supplied by two regular flashlight batteries. Ideal for home-to-garage, house-to-barn, office-to-shop, etc. You'll find many uses that make these worth much more than our price . Set of 2 **7.95**
Same as above, but uses 1½V batteries which we supply Set of 2 . . . $7.25

**BH-1 RADIO HEADSET** – Excellent condition. Low impedence. Adjustable leather covered headband. Ideal for amateur radio. **1.59**

**RAWHIDE MALLET** Weighs 2½ lbs. Has metal collar with rolled leather insert head. Used for working soft metal, plastic driving pins, etc. Leather is replaceable. ONLY **1.09**

**VALUABLE GEAR BARGAINS!**
8 to 1 ratio, spindle drive #110 . . . . . $2.98
6 to 1 with screw shaft #111 . . . . . $4.98
85 to 1 (can be used for radio, antennae, etc.) . . #112 . . $3.95
# G-11 - 10-1 gear ratio . . . . . $3.95

**COMFO RESPIRATOR** Approved by the U.S. Bureau of Mines for DUST And MIST! Very high filtering efficiency is obtained thru unusually large filter area. New cushion face-piece fits comfortably and permits the wearing of goggles & helmets. Easy vision – adjustable head strap. Single filter for all dusts. Respirator plus 10 extra filters. Complete ONLY **1.79**

**NEW DUST RESPIRATOR** M-1 Valve Type. Rubber on in side, felt filter outside. Rubber valves. Adj. headband. Light–Comfortable. . **29c**

Many other Respirators in Stock Write for complete information

**PNEUMATIC AND AIR TOOLS** 10,000 in various popular makes, sizes, types, Cleco, Aro, Ingersol Rand, Chicago, Pneumatic, Buckeye, etc.

#180 **RIVET GUNS** Pistol & Gooseneck Type $55 Gooseneck VALUE **$8.95** #181 PISTOL

**NEW MACHINE TOOL CATALOG** 72 pages of taps, drills, dies, reamers, etc. Hydraulic Cylinders & Valves, Air Tools, etc. Send 25¢ to cover mailing.

**PLEXI DOME** Overall length 21" – Width at widest point 11" – at base 4". 6" deep. For Fish & Flower Bowls – Cab Roof – **1.69**

**New SUN VISOR** Made of clear grn plastic. Adjustable arm & swivel head. Holds firmly. Can be swung in any direction. Made for the Air Corp. Very useful on your Car, Tractor, Truck or Boat. SPECIAL **1.29**

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War Surplus – Tools, Machinery, Raw Materials, Clothing, etc. Illustrated with valuable info., tables, charts & data. Send 25¢ to cover handling & postage.

**PALLEY FAMOUS MIXES!!** Prepared especially for the HOME CRAFTSMAN, HOBBYIST, INVENTOR, GADGETEER or SHOP MECHANIC.

**GADGET MIX** – Rivets, Spacers, Bolts, Screws, Gears, Wheel bearings, Springs and Clamps. No. 106, 5 lbs. . . . . **1.19**

**BEARING MIX. No. 170A.** Approx. 20 needle, Ball & Roller Bearings, New & Used. Sizes: 1/2" to 4". Some of these cost Gov't $10 a piece. Never such a value! 5 lbs. **ONLY** . . . . . **1.59**

**HINGE MIX, No. 170H.** 12 pairs of Strap and butt hinges, Hasps, 1" x 1" to 7/8" x 10" in length and 8" strap. 2 lbs. **1.09**

**ABRASIVE AND GRINDING WHEEL MIX** – 50 pieces including honing stone, pencil rolls, wheels, etc. A sharp value. No. 170AG **99c**

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**RIVET MIX – 3 POUNDS** – Consisting of sizes from 1/4" long to 3" long in many diameters & alloys. **1.19**

**FILE MIX** – Ten assorted Files, 4" to 12", includes 3 Vixens, half rounds bastards, mills, etc., in seconds and used but in good condition. 1 Vixen alone worth our price for entire mix. F-1 **99c**

**PULLEY MIX, No. PM-1** – You'll want this one around. 10 micarta & metal pulleys ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made with 100's of uses. **A WONDERFUL BUY!!!** **2.95**

**COUNTERSINK MIX, No. 168.** Wide assortment. Excellent condition. High speed steel. Assortment of ten 100° and 110° with pilot sizes ranging from 3/32" to 3/16" No. CM-1 **2.69**

**SCREW MIX** – 5 lbs. incl. 2½ lbs. wood screws & 2½ lbs. machine screws. All sizes. Save dollars and alway have plenty of screws on hand. . **1.39**

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**REAMER MIX** – No. 168. Reamer assortment: Special Taper line finish Reamers. High Speed Steel. Slightly used but in excellent condition. Ten assorted sizes ranging from .168x.165 & .244x215 to .425x.385 & .432x.403. One alone worth our selling price of ten. For set of ten Reamers . . . **4.49**

**PLASTIC MALLET** CLEAR PLASTIC with 2" dia. x 4" head & 12" handle. For soft metal or plastic work where non-marking or light tapping is desired. **79c** ea.

**15" MONKEY WRENCH**
Adjustable Jaw – Opens to 4"
Drop Forged. . .Auto Type.
Cadmium Plated **89c** Black **79c**

**PIANO HINGE**

| Overall Width | Length | Price Ea. |
|---|---|---|
| 1¼" (5/8" side) | 72" alum. | $1.00 |
| 2" (1" side) | 9' alum. . . . . | $1.75 |
| 3½" (1-3/4") | 54" st. steel | $1.69 |

**PALLEY SUPPLY COMPANY**
6321 SAN FERNANDO RD.
DEPT. PS-4 GLENDALE 1, CALIF

**No. 100 WINCH HOIST**
A sturdy, dependable hoist, originally used as bomb hoist in B-29's. Capacity 2500 lbs. with 24 to 1 gear ratio. Has bronze worm gear and drum has 19 ft. of 1/4" flex. steel cable with hook on end, and two speed handle. Ideal for shops, garages tow-trucks, boats. . . . . **$21.99**

New Westinghouse
**AIR COMPRESSOR**
Thousands now in use for spraying, inflating, industrial use, trucks, tractors – air tools, laboratory, garage, etc. Lightweight but powerful, can be run by ½ H.P. Motor or Gas Engine. Operates in either direction of operation. Gives approx. 3.27 CFM at 600 RPM, 6.54 CFM displacement at 1200 RPM. Has 2 inch bore, 1½" stroke. Suggested pressure 75 P.S.I. Size: 9" x 12" x 16½". Wt. approx. 23 lbs.
**AT THIS NEW LOW PRICE 21.00**
Motors, Tanks, Fittings to adapt this unit also available AT GREAT SAVINGS TO YOU"

**NEW PRESSURE TANKS**
Stainless Steel, Shatterproof & Rustless. Ideal for painting, cooking, spraying, ocean buoys, underwater fishing, or diving.
G-1 – 12½ x 24 inches. 2100 Cu. In. capacity . . . . . NEW **4.75**
F-1 – 10 x 18 inches. 1000 Cu. In. capacity . . . . . USED **4.19**
F-2 – 6 x 45 inches. 1000 Cu. In. capacity . . . . . NEW **3.95**
D-2 – 6½ x 24 inches. 500 Cu. In. capacity. Stainless Steel Construction . . . . . USED **3.49**
D-2A – Corrosion resistant steel. Same as D-2 . . . . . NEW **2.49**
A-6 – 5½ x 15 inches. 280 Cu. In. capacity . . . . . USED **2.25**
A-4 – 5 x 8 inches. 104 Cu. In. capacity . . . . . NEW **1.35**
NOTE: All tanks listed as used are guaranteed servicable and free from leaks or dents.

**FIRE EXTINGUISHER**
Kiddie Lux $CO^2$ Type. Built to Gov't spec. Shatter-proof, heavy case. Fully re-charged, with horn
No. 601C – 2 lb. wheel control . . . . . **11.75**
No. 602A – 7½ lb. $35 Value. **19.25**
No. 603 – 10 lb. A $65 Value. . . **25.75**
No. 605-A – 15 lb. New. Break disc Type. A $75 Value . . . **29.75**
No. 605-B – 15 lb. Wheel Control Type . . . . . **32.95**
No. 605-C – 15 lb. New. Squeeze Grip Type. $85 Value . . **39.95**

**Pressure Bottle**
Steel - Tested to 3000 P.S.I. For spray painting, portable welding, etc. All have std. pipe port.
H-3 9½" x 3¼" dia. . . . $1.75
H-4 19" x 3¾" dia. . . . . $2.75
H-5 – 22 cu. ft. cap. internal vol. 295 cu. in. Shatterproof 20" long x 5" OD . . . . . $3.75
H-1 For Diving or Inflating tires, with $CO^2$ - has dial gauge. 36" hose. 2.29

**OXFORD BRG & TOOL SCRAPERS**
Complete set of 5 Tools packed in Grained Wood Case.
Contains 1 ea. 8", 10", 12", 14" half round scraper. 1—6" Three square Scraper. 1—12" Double end Scraper. Made of Finest Tool Steel. Forged. Tempered. and Hollow Ground. An Unheard of Price! **SET $2.49**

**New CLAMP**
Carpenters, Cabinet makers, Wood workers you need this one! Opens to 8" with 2 3/4" thumb screw. All Steel sturdy and dependable. Handy for gluing, etc. ONLY **$1.59**

**METAL SNIPS** – Hard steel blades. Comp'nd action. Expansion spring & lock'g device. Right and Left hand types . . **$2.59**

**TWO HEAT SOLDERING IRON**
World's Hottest Iron Value!
Two soldering irons in one with button heat control. Push the button—Select 150 or 300 Watt heat for light or heavy work. Complete with tip, bench holder, 5' asbestos cord. 110V AC.
A $15.00 Value For . . . **3.95**

**HANDY REPAIR KIT**
Here's one for every purpose! 6 useful tools...a steel trimming knife – pair of genuine WISS Heavy Duty scissors, – a sealing roller for cementing fabrics, 2-12" half round files & a burnishing brush. Ideal for wallpaper, linoleum, etc. Comes in compact cloth roll.
A 9.50 Value For . . . . . **3.29**

**U.S. NAVY BATTLE LANTERN** – A powerful lamp complete with 2 1½ volt dry cell batteries. Size: – " x 7" x 4" . . . . **3.29**

**MICARTA TUBE**
Ideal for Insulating or Bushing Stock. 36" x ¼" wall x 1" O.D. Original use was for trailing antenna – F 10. Use for towel rack, bearings, etc. **59¢ ea.**

**Hydrogen Regulator**
Made by AIRCO Mfg. Co., Has 1 – 3000 lb., tank gauge & 1 – 60 lb. regulator gauge.
A Real Buy at . . **18.95**

Sperry Aircraft Directional
**GYRO COMPASS**
Dial is 360° swing calibrated 1/10° (6 min). Panel Mount 4½" square with 3" luminous dial. Can be used in autos, planes, or boats by attaching one tube to intake manifold for required vacuum. Complete with reset caging knob. Gov't. overhauled – ONLY . . . . . **$4.49**

**D. C. GENERATORS**
Suitable for adaption to home welding units, portable and rural lighting, power plant on boats, etc

| TYPE | AMPS | VOLTS | |
|---|---|---|---|
| P1 | 200 | 27½ | 17.95 |
| R1 | 300 | 30 | 29.75 |
| E5A | 50 | 12 | 14.95 |
| Above used, but in guaranteed condition. | | | |
| 03 NEW | 100 | 24 | 18.95 |

**D. C. METERS**

| AMMETERS | VOLTMETERS |
|---|---|
| - 30 - 0 - 30 + | 0 - 120 |
| - 60 - 0 - 60 + | 0 - 240 |
| -120 - 0 - 120 + | 0 - 300 |

0-30 **$3.95**
Your choice 3.95 ea.
COMBINATION VOLTMETER - AMMETER
30V – 30 AMP **$4.95**
30V – 60 AMP
All meters 2" face except 0-300 which is 3" face.
SHUNTS - Required for use with D.C. Ammeters 30–60–120–240 **$1.00**
SOLD ONLY WITH METERS.

**NEW ELECTRIC MOTORS**
No. 500 – New ½ HP – 27 Volt DC-AC. This motor can be readily adapted to deliver up to ½ HP on 110 Volts AC by the simple method of rearranging armature brush-leads. Free diagram with each order. A sensational Value . . . . . **$5.95**
No. 500-A – Converted to 110 Volts-AC Equipped with plug and 3½ ft. Heavy Duty Cord . . . . . **$8.49** ea.
No. 502 – 2 HP-24V. DC Motor Used . . . . . **8.95**

**AIRCRAFT CABLE**
Rust resistant alloyed steel, extra flexible, preformed – 7 x 19 strand-on reels.

| | |
|---|---|
| 1/16" . . . . . 3¢ ft. | 1/4" . . . . . 8¢ ft. |
| 3/32" . . . . . 4¢ ft. | 9/32" . . . . . 9¢ ft. |
| 1/8" . . . . . 4½¢ ft. | 3/8" . . . . . 12¢ ft. |
| 5/32" . . . . . 5¢ ft. | 1/2" . . . . . 15¢ ft. |
| 3/16" . . . . . 6¢ ft. | 1/4" Bronze 14¢ ft. |

1/8" Stainless Steel, per. foot . . . 12c
Aircraft control cable 18 ft. long, 3/16 in. diam. with turnbuckle ends. **99c**

**NEW HYDRAULIC CYLINDER SPECIAL**
Gives 20,000 lb. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3,000 lb. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1½" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm & shop machinery, presses, etc. Cost Gov't $390.00 **22.50**

**No. 9-E HYDRAULIC CYLINDER**
Double action cylinder. Has a bore of 1-3/8" and shaft of 1". Stroke is 9" Overall length 15¾". Built for 1500 lbs. continuous duty, 3000 lbs. intermittent duty. Will lift or push up to 2300 lbs. Can be adapted to hundreds of jobs. NOW **8.95**

**No. 3 HYDRAULIC CYLINDER** –
Double action. Bore is 1". Shaft ½". Has a stroke of 2½ to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs. **3.75**

**BENDIX HYDRAULIC HAND PUMP**
Provides an instantaneous source of tremendous power for almost any heavy work. Double action stroke. Delivers .30 cu. in. per cycle at 3000 PSI. Max. press. 5000 PSI. Built-in Reservoir cap. 2¼ qts. 3/8" pipe outlets. Has Pressure Release Valve. 7¾" dia. by 23 3/16" overall ht. Weight 15.2 lbs. A $40.00 Value for...NEW **$15.95**
Used - In Good Condition... **11.95**

VT-1
**Vickers Hydraulic Transmission**
Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output R.P.M. - 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2-4" Spline Shafts for input & power take-off - Cost Gov't. approx. $400. **$27.50**

**GEAR BOXES** VTG-1 – 90°, bevel gear 1½ to 1 reduction, size 7" x 6". A Lifetime Value. . . . . **$3.95**
VTG-2 – Inline spur gear 16 to 1 reduction, thru 4 gears. Final take-off 4½" dia, 26 tooth. ¾" Alum. spur gear. . **$6.49**
Both above gear boxes have lever control for engaging & disengaging positive clutch. Dust proof housing. Prelubricated bearings. Both can be adapted to Vickers Transmission.

**ELECTRONIC TRANSMISSION GEAR TRAIN**
GT-1 Containing approx. 50 Bronze Spur & Pinion Gears – ranging from 3/8" to 4" dia., 5 sets of 7 cluster gears, 2 complete worm & worm gear drive sets, 40 N.D. ball bearings from ½" to 1½" dia. watch springs, bushings, posts, face plates, housings – Micro Switches, 2 minature, controlled clutches, etc. 19 lbs Of Pleasure and profit. A Tremendous Gadget Mine. ONLY **$8.49**
Gears in above train are all in multiple size & sequence with identical teeth ratio giving 100's of ideal gear reduction combi.

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## GIL-BILT 10-INCH TILTING ARBOR SAW

- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jack screw mechanism and handwheel, and all other metal parts (less blade) . . . . . $20.95
Same Kit with 10" Combination Blade . $24.90
Same Kit with 8" Combination Blade . . $23.90

## GIL-BILT 8-INCH TILTING TABLE SAW

- 21x27 in. table tilts full 45 degrees, 13 in. capacity in front of blade
- 8 in. blade cuts from 0 to 2½ in.
- New Departure ball bearing arbor, ⅝" precision shaft turned down for ½" bore blades, alum. housing, ready to run
- Cast aluminum miter gauge and self-align. rip fence guide (same as above)

GIL-BILT Metal Parts Kit includes Plans, Ball Bearing Arbor, Miter Gauge and Bar, Rip Fence Guide, Machined Lock Knobs, Tilt Support Segments, and All Other Metal Parts (less blade) . . . . . $15.95
Same Kit with 8" combination blade . . . . . $18.90

## GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings.
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled.
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
- Rubber tired wheels. Choice of cast aluminum or make-your-own wood wheels on metal hubs.
- Uses standard 78 inch blades up to ⅜ inch wide.
- Fully enclosed mechanism for utmost safety.

GIL-BILT Metal Parts Kit includes Plans, rubber tires, ¼ inch blade, hubs for wood wheels, ball bearing spindle, tilt mechanism, guides, table tilt segments and all other metal parts . . . . . $16.95
Same Kit with two machined ready-to-install 12" cast aluminum wheels . . . . . $20.95

**NO DEALERS—One Low Factory Price!** Return kits in 10 days for refund if not satisfied. Prices include postage within 600 miles. Over 600 miles add 5%. Send cash, check, or money order for parts kit, or send $1.00 for Step-by-Step Plans and order kit later less cost of Plans. Plans sent postpaid anywhere in the world.

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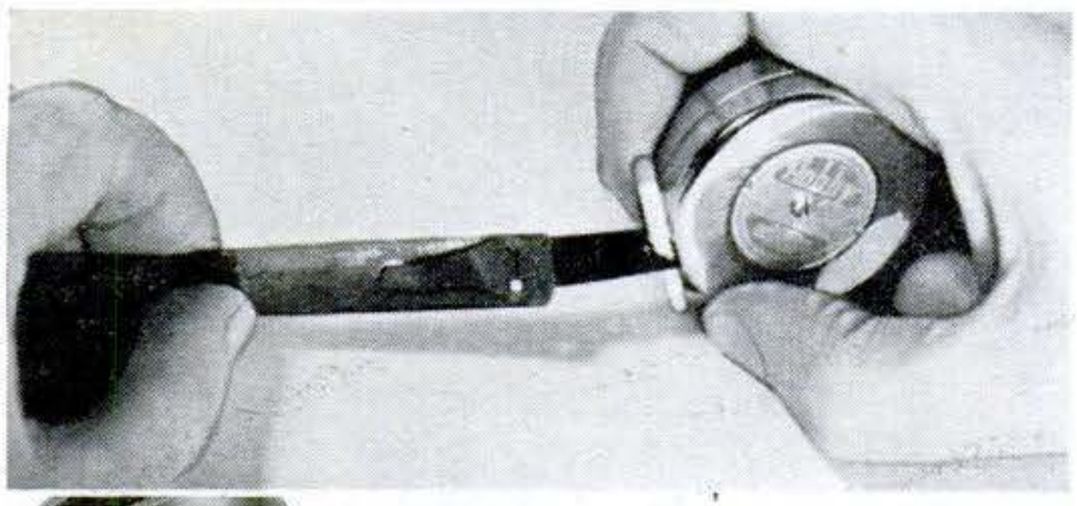
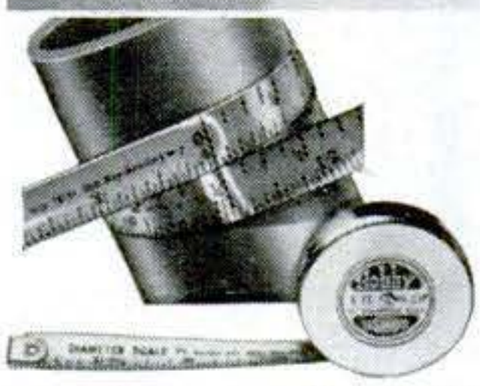
526 CHERRY ST. DEPT. B KANSAS CITY, MISSOURI


# New

**Tools Changed Quickly.** Changing tools with this milling-machine spindle adapter is a matter of seconds. If you tap the release button on the face of the unit, the tool is ejected by hydraulic action. Designed to fit standard spindles, the adapter holds tools with Morse-taper shanks. Greenville Tool & Die Co., Greenville, Mich., makes it.





**Rule Reads Diameters.** With the stretched-out scale on the upper edge of this steel tape, you can measure outside diameters up to 21". Here's how it works: The small photo shows a 2¼" pipe. Read the first whole number on the upper edge of the lower tape. It's 2". Then read over to the figure under the zero on the upper edge of the lower tape. It's ¼", making a total of 2¼". Another feature of this 6' tape (made by Carlson & Sullivan, Monrovia, Calif.) is the replaceable blade. You can install a new blade without opening the case, as shown in the photo above where a new blade is being attached. The rule sells for $1.50.



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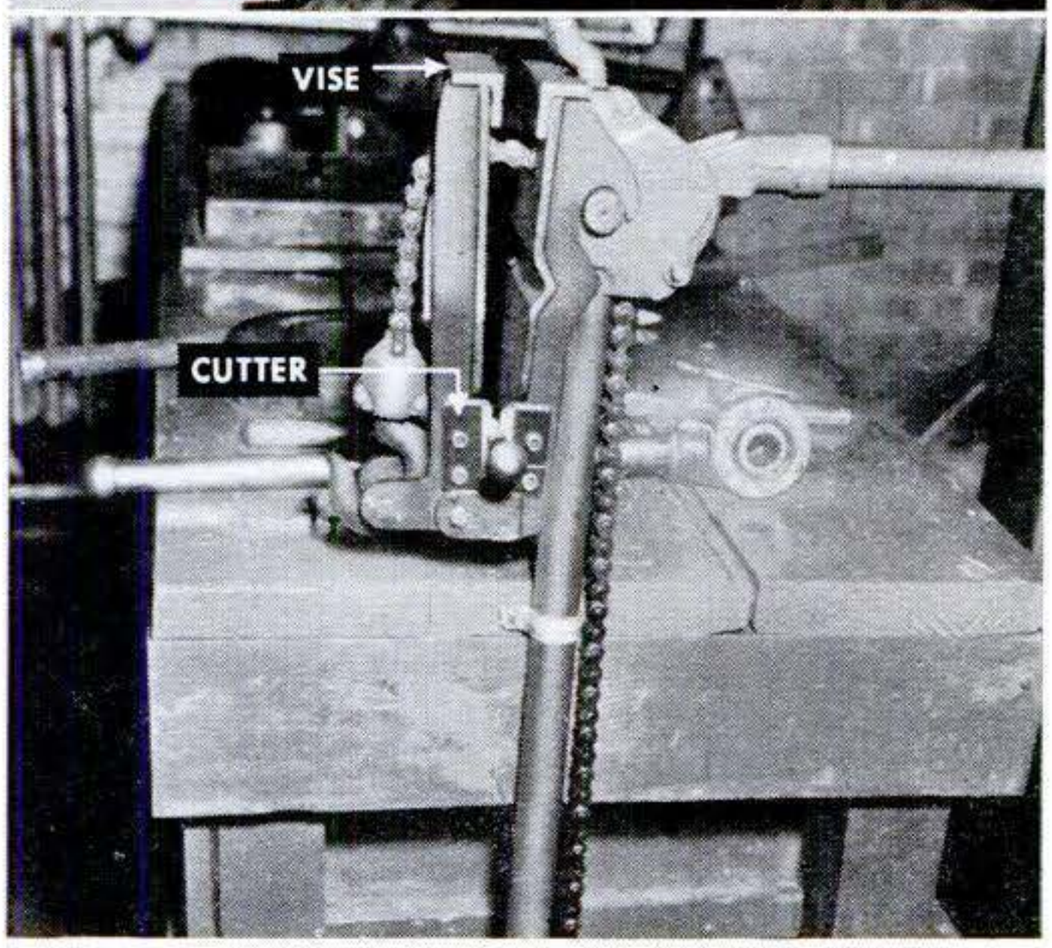
# Tools




**Tool Has Five Uses.** Besides serving as a hoist, this tool also can be used as a high-lift jack, load binder, vise, and bolt cutter. Top photo shows the Hoist-All® as a load binder; lower photo, as a bolt cutter. The tool-steel cutter blades snip wire and bolts from 3/32″ to ⅜″. The vise has an effective opening of 6″.

Without its stand, the tool is a hoist or load binder. Because it lifts or lowers loads on half as well as full strokes, it operates where there is very little headroom. With its stand, the tool is a jack with a 44″ lift. When the vise and cutter attachment are in place, the versatility of the Hoist-All is further increased. It comes in two sizes with lifting capacities of 2,000 and 4,000 lb. The Coffing Hoist Co., Danville, Ill., is the maker.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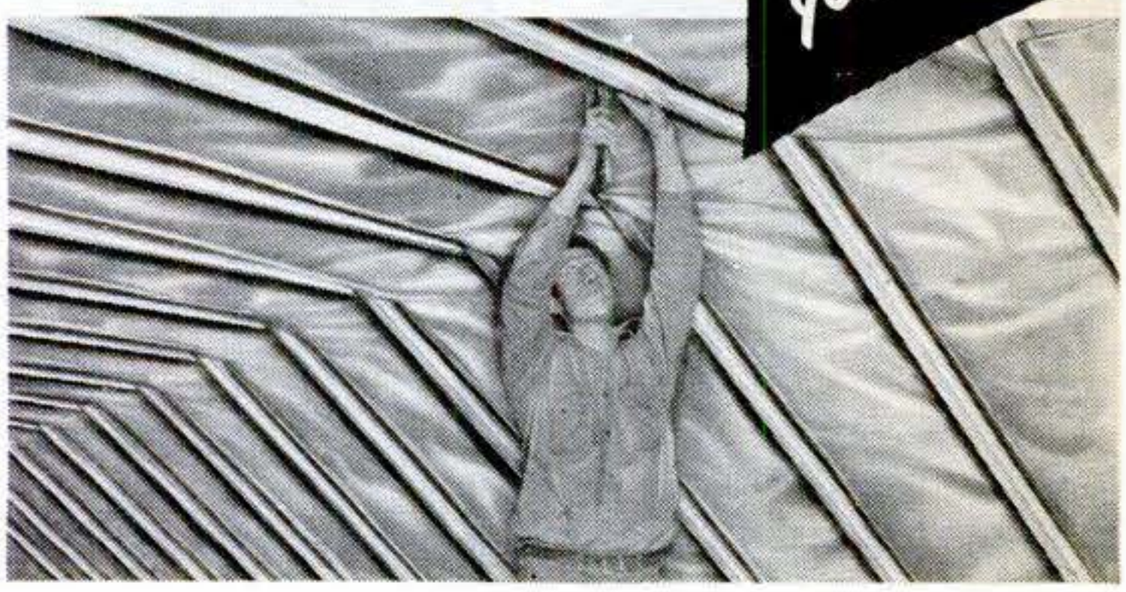
## REYNOLDS ALUMINUM
# REFLECTIVE INSULATION

install it yourself!



Put the magic of aluminum to work in your walls, attic! Reflects up to 95% of all radiant heat — throws off summer sun rays, keeps interiors up to 15° cooler; reflects winter heat back inside. Embossed aluminum foil bonded to tough kraft paper (foil on both sides for double air space; on one side, to face single air space). Clean, odorless, pliable, easy to tack or staple over ceiling joists or under rafters, between wall studs, under floor joists. Perfect vapor barrier. Fire-retardant. In rolls of 250 sq. ft., 25″, 33″ and 36″ wide. *Also makes wonderful radiator reflectors, photographic light reflectors, etc.* MAIL COUPON FOR FREE SAMPLES!

**Aluminum Sheet for Rustproof Flashing, Termite Shielding, General Shop Work!**

**Reynolds *Lifetime* Aluminum in 50-ft. coils, 14″, 20″ and 28″ wide, .019″ thick; and flat sheet .019″ and .024″ thick, 28″ x 6′, 8′, 10′ and 12′. (20″ coils also in embossed finish and .024″ thickness.)**

**Aluminum Gutters**—Rustproof, non-staining, half the price of other rustproof materials. Put them up yourself...slip joints, no soldering!

**Aluminum Nails**—Rustproof, never stain. Keep outside paint jobs clean without deep setting or puttying.

IF YOU SEE RUST YOU KNOW ITS NOT ALUMINUM

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Does fast, fine sanding, yet is easy to use as a ¼" drill. With its soft, lambswool bonnet it polishes the car, furniture and metals. Here's your one tool workshop that drills, buffs, rubs, grinds, stirs paint and scours pots and pans. Your dealer will be glad to show you SKIL Home Shop Sander-Polisher, tool of 1,000 uses, today.

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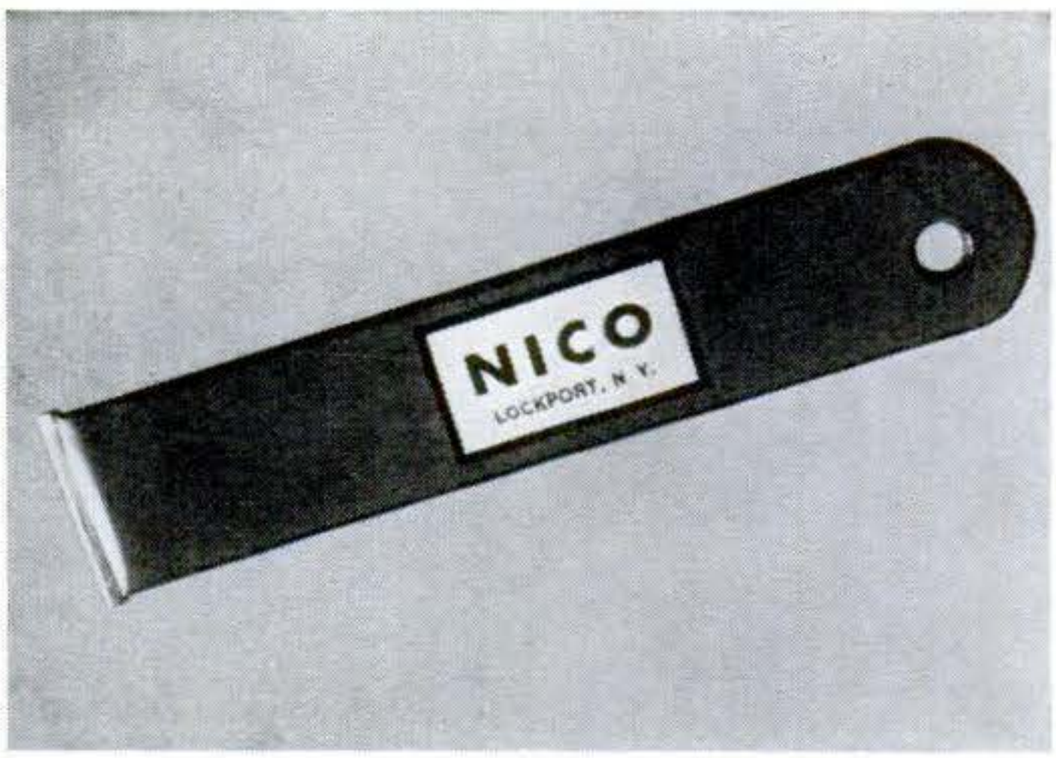
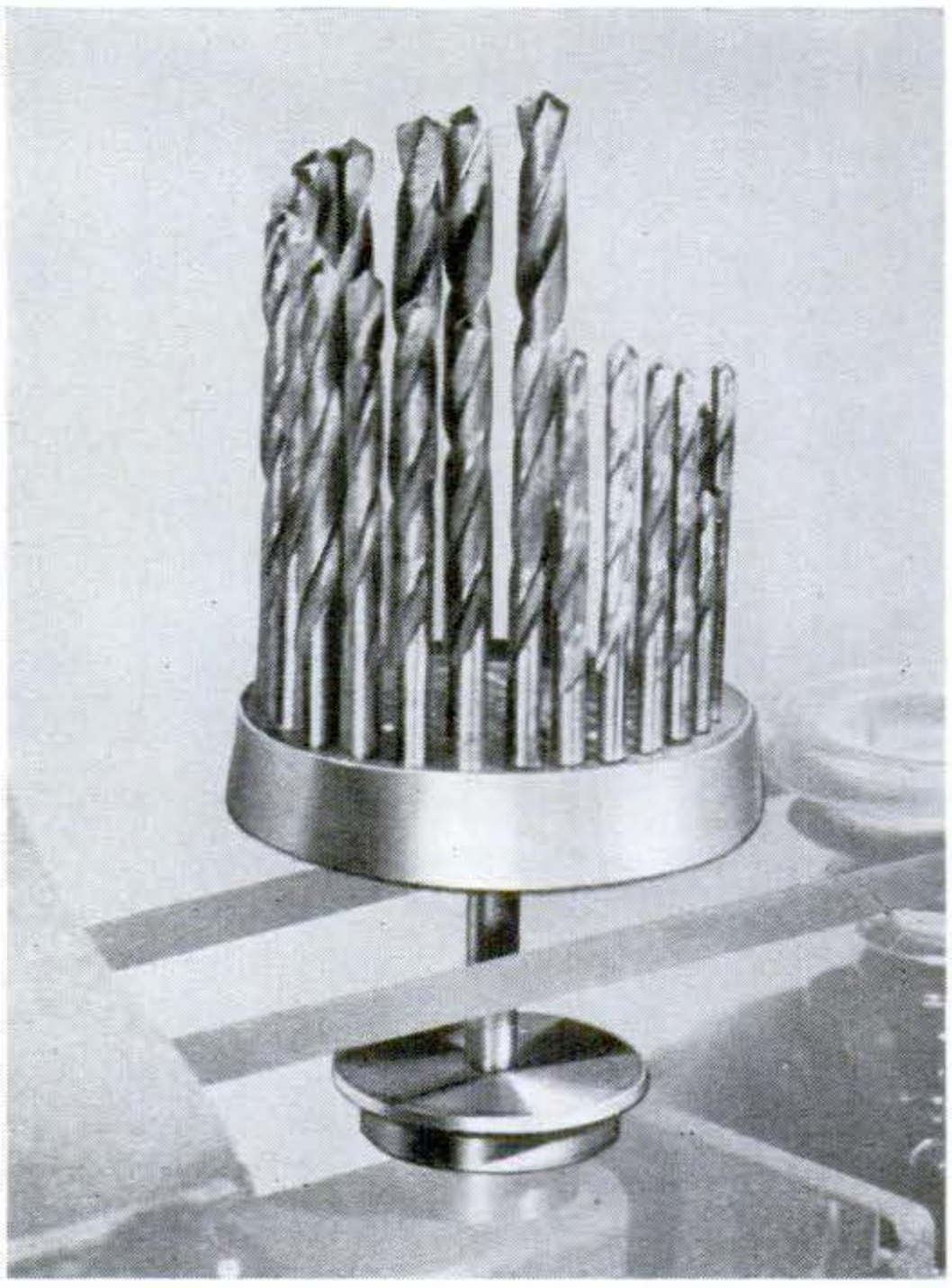
# New Tools




**Paint Scraper Stays Sharp.** The Niagara Instrument Corporation, of Lockport, N. Y., unconditionally guarantees this paint and rust scraper to stay sharp. The 1" blade of the Nico® scraper is tipped with tungsten carbide. Price: $1.



**Drills Stored on Press.** Rotadrill®, sold for $3 by Standard Parts Co., Chicago, fits a drill press having a column with an inside diameter of either 1½" or 2⅜". The fixture fits in the top of the column and holds 29 drills from 1/16" to ½" by 64ths. It can be rotated or lifted off for use at a workbench. The stand is made of aluminum.



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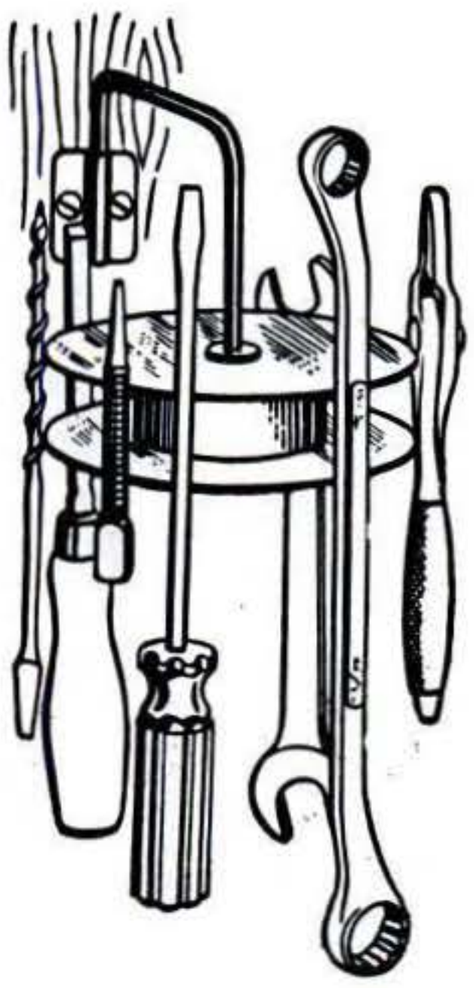
# New Tools

**Hand Tapper.** The four collets supplied with this machine handle tap sizes from No. 0 through ¼", either right- or left-hand. Holding fixtures, such as a vise or angle plate, can be attached to the 6" by 9" slotted base. Capacity over the base is 6¼" and the largest diameter of work the tapper will take centrally is 8". The ⅞" column is 12" high. Travel of the ⅝" spindle is 1⅜". Ball and spring tension prevent the spindle from falling. H. D. Herder Tool Specialties Co., Kalamazoo, Mich., is the maker.



**Magnet Holds Tools.** Knives or tools can be quickly removed or replaced on this magnetic holder. The maker, Ronald Eyrich, of Milwaukee, Wis., prices the unit at about $2. The holder rotates on its bracket, making any tool easily accessible. Its manufacturer says your workbench will stay neater and the tools cleaner and sharper if you store them on this rack.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ON YOUR
FURNITURE BUILDING

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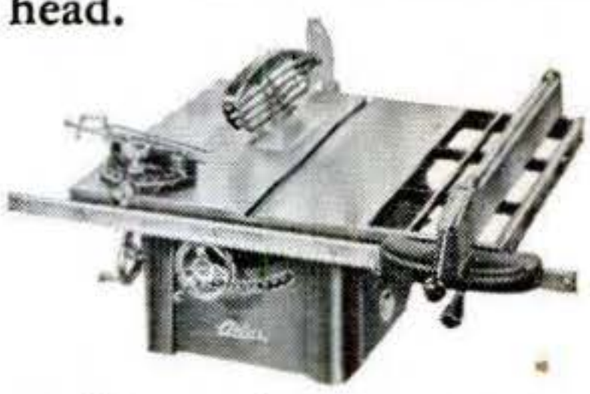
6" JOINTER-PLANER

Now — get "factory" quality on all your fine furniture and cabinet work! This new Atlas 6" Jointer-Planer has the capacity you need — the "production shop" features you want—for expert planing, rabbeting, tongueing, and other jointer work. There's simultaneous blade positioning — entire cutter head raises or lowers. The rear table is stationary for permanent alignment with the front table and cutter head.

And look at these features! Big 42" precision-ground grey iron table, 32" two-way tilting fence, sealed ball bearings. For complete facts on this outstanding new Atlas tool, send postcard or coupon below.



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# P.S. Last minute news & notes...

MUD HOLES can be turned into airfields in five hours by adding an organic salt and two catalysts to soupy soil. This fast new way of producing a tough, rubbery surface that will support heavy loads intrigues military engineers, but the cost makes civilian use doubtful. M.I.T. is testing it for the Army.

NYLON CORD is being used now to reinforce inner tubes for auto tires. U. S. Rubber Co. reports that one of these tubes withstood a test in which the tire was deliberately gashed and the tube exposed to the road for 150 miles

HOW LONG will you live? Average length of life in U. S. rose to 67.2 years in '48. Deaths reported that year included those of 1,363 persons who were 100 or more years old.

FLUID DRIVES similar to those on new cars (p. 98) have been put on Champion outboard motors. The throttle regulates motor speed, and the fluid-clutch control selects propeller speed. At top speed the transmission locks into direct drive.

AMERICA'S FIRST turbo-prop air transport will be a Convair-Liner with two 2,750-hp. Allison engines substituted for its piston engines. It's scheduled to be ready in June. Commercial lines may use it for cargo flights.

WHAT HAPPENS in five billionths of a second can be pictured accurately on an ultrafast oscilloscope recently developed by electronic sharks at Oak Ridge (Tenn.) National Laboratory.

MOTORCYCLE made by the Powell Co., Compton, Calif., stops when oil pressure drops below the safety point. Automatic switch shuts off current from the magneto. This makes it impossible for a rider to let engine burn out for lack of oil.

TWO 65,000-HP. MOTORS, believed to be as powerful as any ever built, will be put in a new pumping station at Grand Coulee Dam this year. Made by GE, they'll help irrigate a vast, rich but dry part of Washington.

WALL PANELS of colored asbestos (Johns-Manville) never need painting because the pigment goes all the way through. When hung on special steel studding, they form walls that are movable.

ELECTRICAL INDUSTRIES need mica for insulators. U. S. has relied largely on imports. But now National Bureau of Standards has found a way to crystallize synthetic mica from materials similar to those used to make glass.

MOVIE COMPANIES on location are now using auto-type sealed-beam lamps. Mounted on magnesium arms, they are easily moved -- and tests show they give more light than regular studio tungstens.

REAL GOLD can be purchased on special decal transfer sheets for gilding your craftwork. The sheets cost only a penny per square inch. M. Swift & Sons, Hartford, Conn., makes them.

FEWER DITCHES will have to be dug and kept open for irrigation when glass-cloth hose is used. A 100-foot section, 9-3/4 inches in diameter, weighs only 45 lbs. It is made by Holton Corp., New Orleans.

FIRST big planetarium completely made in America will be put in an Ozark cave near Waynesville, Mo. . . . Latest estimate is that 8,000,000 TV sets will be in use by next January. . . . De Havilland's four-jet airliner, the Comet, will sell in U. S. for about $1,250,000.

The Editors



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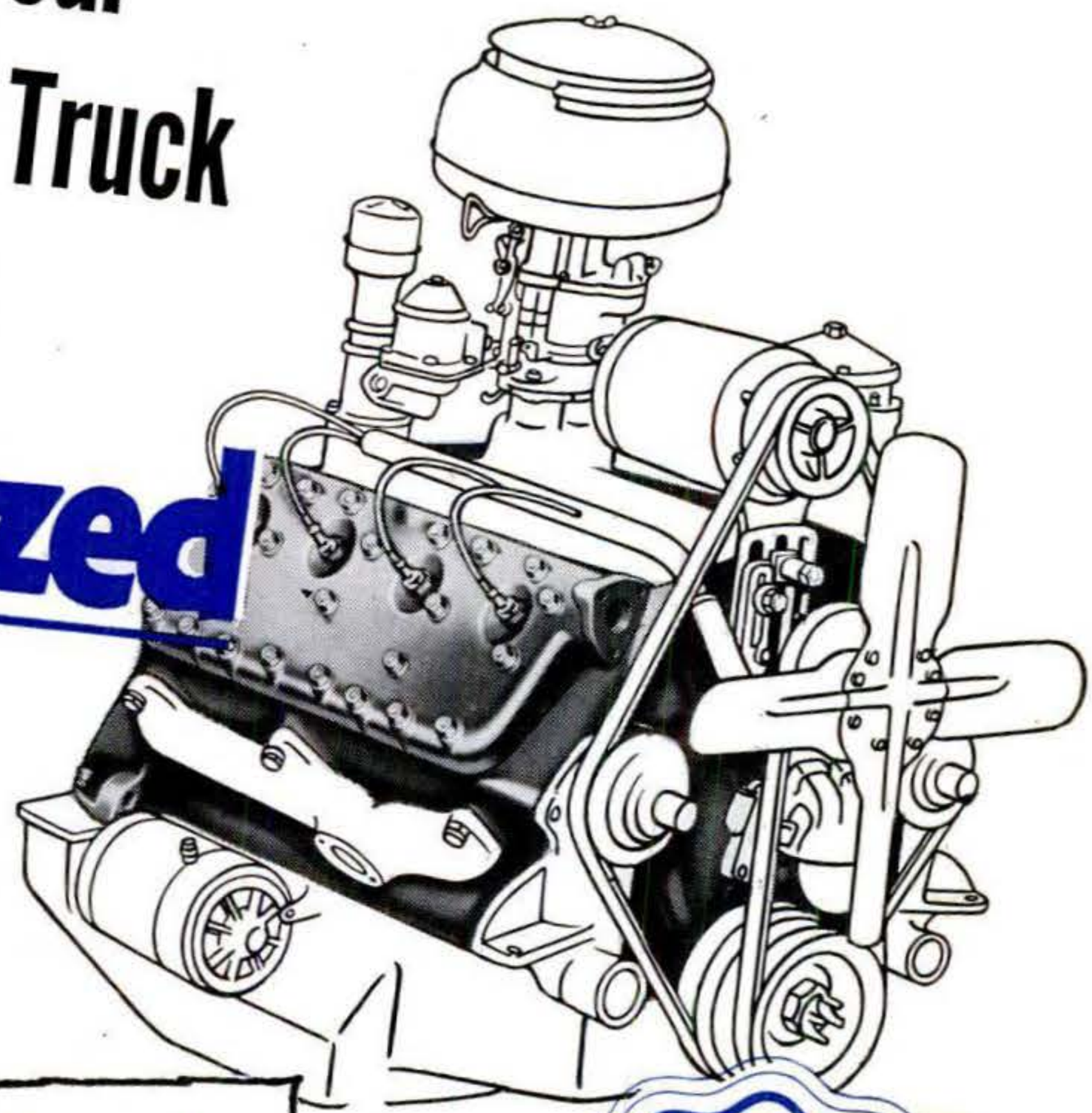
# Repower your FORD Car or Truck with an Authorized Reconditioned Ford Engine



**ONLY AN Authorized RECONDITIONED FORD ENGINE GIVES YOU ALL THIS:**

- ★ One-day installation.
- ★ Genuine Ford Parts—new or completely reconditioned.
- ★ Built and tested to Ford-factory standards in Ford-authorized, Ford-inspected plants.
- ★ Material and workmanship fully guaranteed by authorized reconditioner.
- ★ Costs only a few dollars more than a ring and re-bore job.

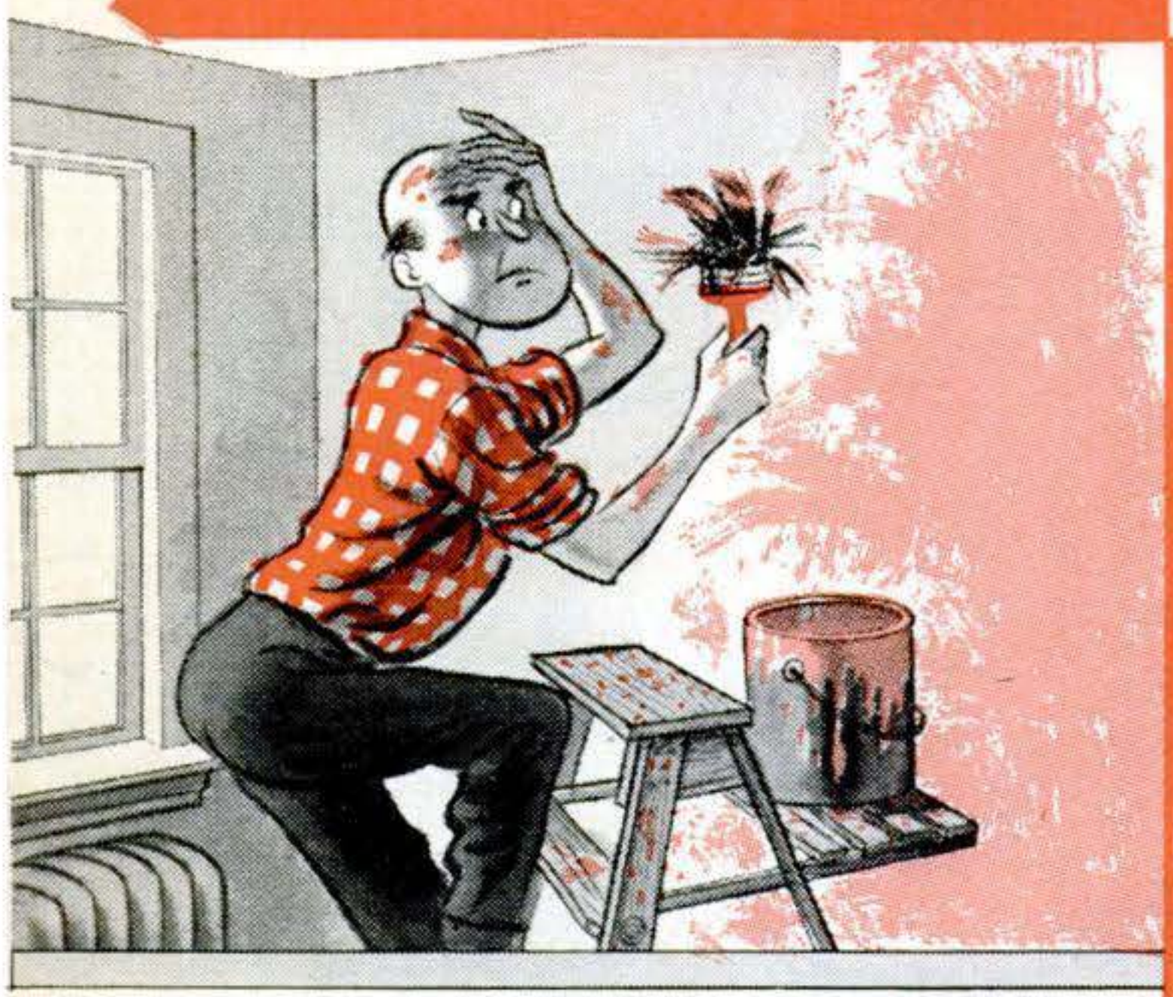
Look for this emblem

For complete information see your friendly Ford dealer or independent garage displaying the Authorized emblem and selling AUTHORIZED Reconditioned Ford Engine and Engine Accessories.

WHEN YOUR PAINTING TURNS OUT LIKE THIS...IT'S TIME FOR A NEW BRUSH...

*and*

IF YOUR CAR FEELS LIKE THIS ...IT'S TIME FOR **MARFAK** CHASSIS LUBRICATION



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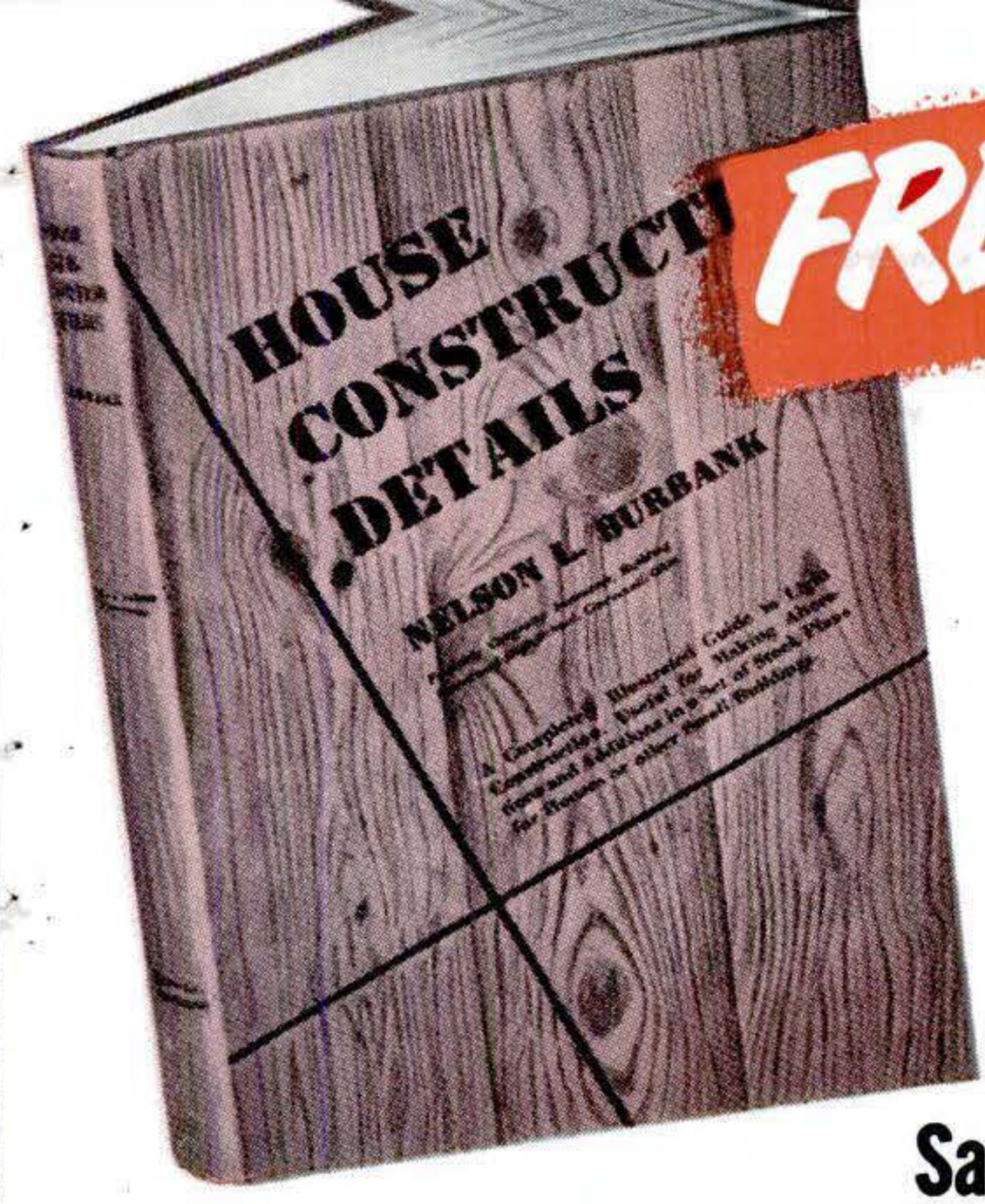


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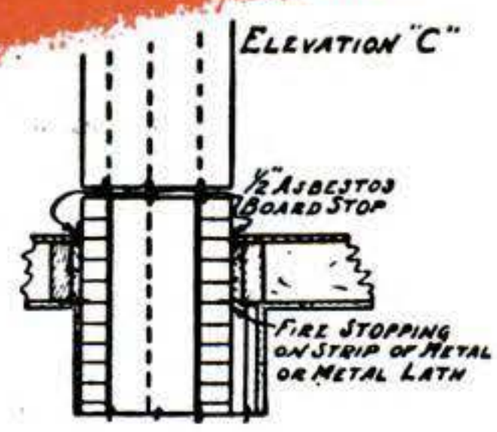


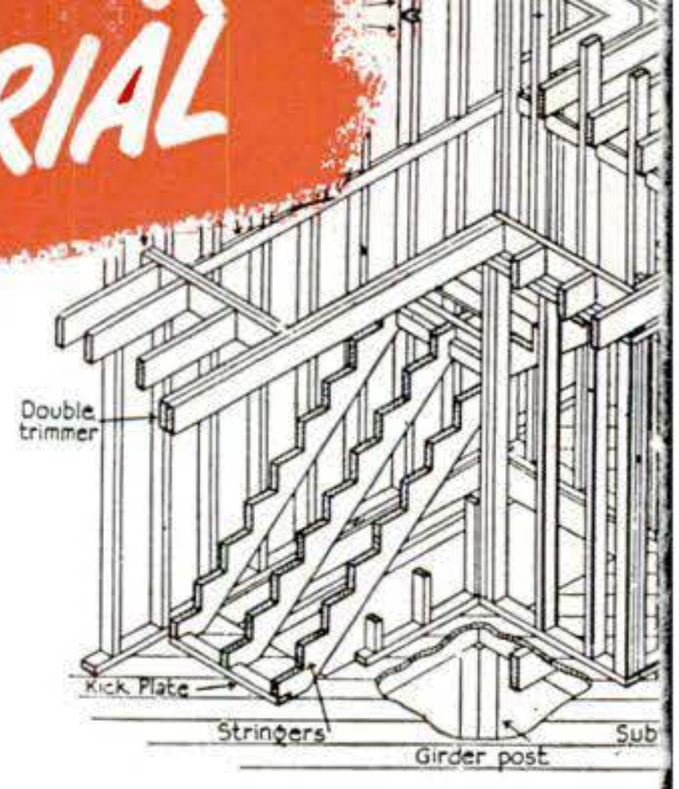


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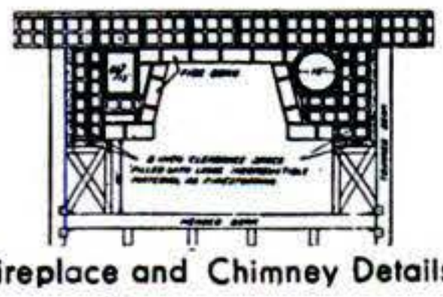
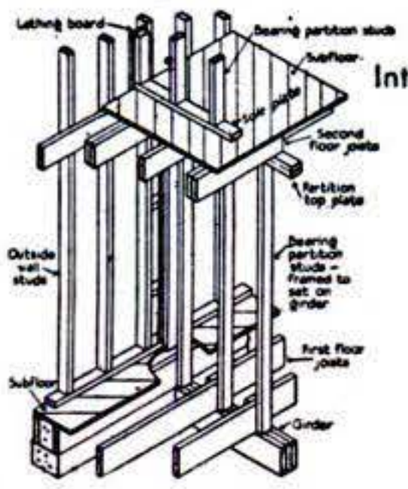
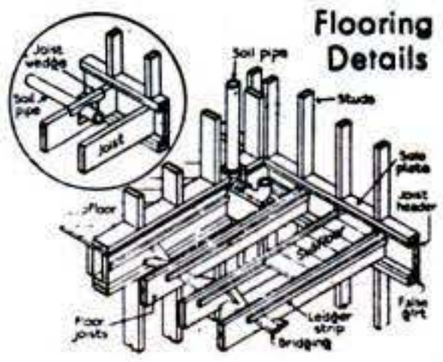

Fireplace and Chimney Details

Electric Wiring


Interior Wall Framing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